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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.
ISSUED WEEKLY BY THE AMERICAN MACHINIST PRESS.
Vol. 22. 218 WILLIAM STREET, NEW YORK. No. 23.

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20—Nicholson File Co.
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Anent this Front Cover

On August 6, 1896, the front page of the American Machinist was first offered for sale.

We knew that it was the most prominent spot on earth for an advertisement intended for the users or buyers of machinery or engineering supplies used by machinery makers.

We said we wanted $100 an issue for that space, and we also said we would not let any concern have it twice in succession if any other concern wanted it—tried to give everybody a show at the best.

Then we were tempted; one of our best advertisers offered us $5,000 for that page for a year, but we kept our oath.

Had to fill that space with our own ads. for the best half of the year though—*but they did us good.*

For the past eighteen months every issue has been occupied by a pleased advertiser—and the next eighteen months are contracted for.

This issue is left vacant because of a verbal agreement between an advertiser and our solicitor, not known to us, and copy declined too late to sell the space, and we are rather glad of this chance to use it.

Every now and then some of the people who have agreed to take this space want their date set ahead or back, but we find it hard to get people to change. Men who buy this space know what they want and when they want it.

In the column beside this sermon will be found a list of the dates and names of the parties who have agreed to take that space for each date. If you want to trade do so direct.

As will be seen every issue of 1899 is engaged, and all but six in 1900. We have orders for over twenty for 1901, and four for 1902, *but we will not assign space for 1901 until June 1, 1900,* then we will take all the applications on hand, in the order received, and assign a date for each firm; after that the repeat orders will be given their place.

We want everybody to have a chance at this front cover. More mechanics, more heads of machinery-making concerns, more men responsible for results in shops the world over, will see an ad. there than would see it if it was painted in forty-four foot letters from end to end of the Chinese wall, on four sides of all the pyramids and the eastern slope of the Rocky Mountains.

Big things are not always most effective—remember the busy bee and the point he makes.

The Machinist goes home with the boss, sits up with the general foreman, and is a silent partner of the chief draftsman. It works overtime without looking at the clock, and Sundays don't prevent it from doing all the good it can.

This front cover is cheap at $100, but we can't offer you that space now. Just advertising this way to prove to you that ads. in the American Machinist pay, and the best people in the business say so—by their orders.

Please don't write asking us if we can arrange for you to use the front cover soon—we can't.

But there is good space inside, in good, clean company, and you are always welcome—if you are in our line. If you sell corsets, or manhood restored, or tooth powder, you can't get in anyway. And it wouldn't do you any good if you did.

It's a Waste Of Time

to look for better wood working machinery than Whitney's because there isn't any better. In sixty years of building this class of machinery, Whitney has learned how to build machines that have no superiors.

A good many people who ought to know will tell you that Whitney's machines are much better than any other, and are cheaper to buy, even at a slightly higher price.

Baxter D. Whitney,

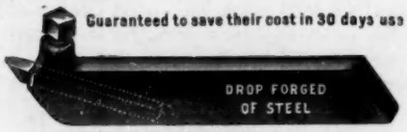
Winchendon, Mass.

TOOL HOLDERS,

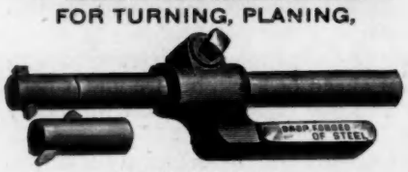
With Self-Hardening Steel Cutters.

Pat. Feb. 16, '86, Feb. 28, '93, Mar. 12,' 95.

Guaranteed to save their cost in 30 days use



FOR TURNING, PLANING,



BORING AND

CUTTING-OFF METALS.

40 styles and sizes. 200,000 in use.

Manufactured only by

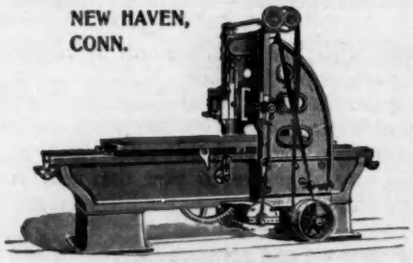
Armstrong Bros. Tool Company,

CHICAGO, ILL., U. S. A.

SEND FOR CATALOG.

NEW HAVEN MFG. CO.

NEW HAVEN, CONN.



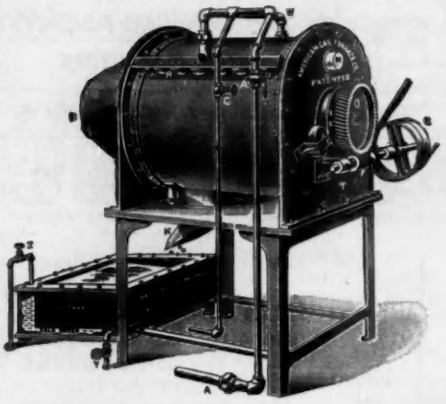
MANUFACTURERS OF

IRON WORKING MACHINERY.

Heating Machine No. 5

is what the American Gas Furnace Co. calls a machine they make for hardening bicycle balls, saw teeth, pens, nuts, bolts, screws and other articles not exceeding two and a half inches in any dimension.

Like this company's other productions, this machine best demonstrates its usefulness and economy on the most particular work—on work that requires the most exacting treatment.



Steel work of any shape is evenly and thoroughly heated to the exact degree required—there's no burning of a thin part to bring a thicker part to the right temperature. This machine is capable of heating from 1500 to 2000 pounds of steel work per day, the rate of delivery depending upon weight and shape of the pieces, and with a uniformity of results that is practically unknown to any other method.

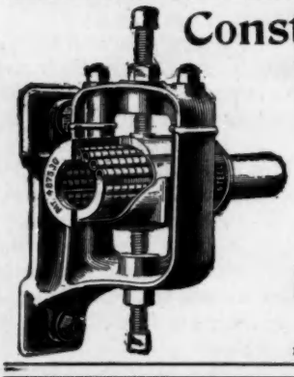
We'll gladly tell you all we know about it, if you'll ask us.

American Gas Furnace Co.,

23 John Street, New York.

Chas. Churchill & Co., London and Birmingham. Schuchardt & Schutte, Berlin, Cologne, Vienna, Brussels, Stockholm, New York. Glaenzer & Perreaud, Paris.

We know a few things about Fuel Gas Plants, too.



Constant Dropping Wears Away the Stone.

Week after week we iterate and reiterate the fact that Hyatt Roller Bearings are a saving grace. Perhaps some day we may touch your stony heart by way of your pocket book.

May we send you our Catalog?

Hyatt Roller Bearing Co.

HARRISON, N. J.

133 Liberty Street, New York.

When You Want The Best

that money can buy in electrical machinery you should look the market over carefully. It is this kind of investigation that pleases us, for you are then sure to

Buy Bullock Generators and Motors.

They are built in the most modern works in the world.

Bullock Electric Mfg. Co., Cincinnati, O., U.S.A.

11 6-1-99

Iron Working Machinery, For Immediate Delivery. **W. R. Colcord Machinery Co.,** 423-425 N. SECOND ST., ST. LOUIS, MO.

Our Annealed Die and Tool Steel

Saves Time, Labor, Money.

Crescent Steel Company,
Pittsburgh, Pa.
Chicago, Ill.
New York, N. Y.
Denver, Col.

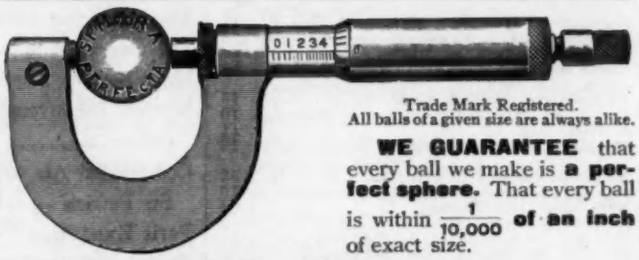
DRILLS 20 TO 40 INCH SWING.

Modern, Accurate, Strong, Convenient.
Prices Correct. Delivery Prompt.

CINCINNATI MACHINE TOOL CO.,
AUGUST H. TUECHTER and SHERMAN C. SCHAUER,
Western Ave. and Dayton St., Cincinnati, Ohio, U.S.A.

You Are Wasting Money

If you are using imperfect balls after perfecting your cups and cones.



Trade Mark Registered.
All balls of a given size are always alike.

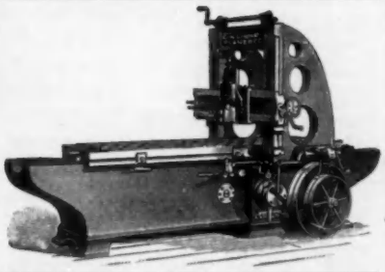
WE GUARANTEE that every ball we make is **a perfect sphere.** That every ball is within $\frac{1}{10,000}$ **of an inch** of exact size.

The Steel Ball Company,

Chicago, Ill., U. S. A.

PLANERS

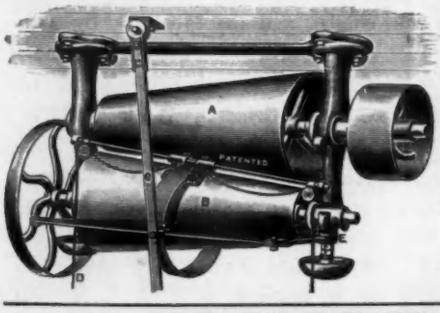
24 inches to 36 inches square.



The Cincinnati Planer Co.
WORKS: CINCINNATI, OHIO, U. S. A.
Cable Address: Planer-Cincinnati.

EVANS FRICTION CONES. Nearly 6,000 Sets in operation in this country and Europe.

THE following is a partial list of Manufacturers who have Evans Friction Cone Pulleys in successful operation, transmitting from ONE TO FORTY HORSE POWER. . . .



National Biscuit Co., Richmond, Ind., . . 150 Sets, 6 H. P.
John & James Dobson, Philadelphia, Pa. . 34 Sets, 2 H. P.
Samuel Cupples Envelope Co., 6th and Cerre Sts., St. Louis, 25 Sets, 3 H. P.
Atlas Cement Co., 143 Liberty St., New York, 8 Sets, 20 H. P.
Washburn & Moen, Worcester, Mass.—Waukegan, Ill., A large number, all sizes.
Nonotuck Mills, Holyoke, Mass., 1 Set, 40 H. P., 16 Sets, 6 H. P.
Stinson Brothers, Carpet Mfgrs., Philadelphia, 40 Sets, 2 H. P.
Massasoit Paper Company, Holyoke, Mass., 2 Sets, 40 H. P.
Trenton Iron Company, Trenton, N. J., 9 Sets, 2 to 6 H. P.
Taunton Copper Company, Taunton, Mass., 8 Sets, 2 to 6 H. P.
F. W. Bird, East Walpole, Mass., . . 2 Sets, 40 H. P.
Arnold Print Works, North Adams, Mass., 10 Sets, 6 H. P.
Merrimack Mills, Lowell, Mass., . . 18 Sets, 10 H. P.
Dennison Mfg. Co., South Framingham, Mass., [redacted] Large number of small sizes.

C. W. BURTON, GRIFFITHS & CO., London Agents.

Send to G. F. EVANS, 85 Water Street, Boston, Mass., for illustrated Catalog.

KEYSEATERS SIX SIZES

HUNDREDS IN USE.

All jobs chucked by the bore; hubs need not be faced.
Shaft Keyseaters also. Send for Catalog.

MITTS & MERRILL, 913 Tilden Street,
SAGINAW, MICHIGAN.

EUROPEAN AGENTS:
Great Britain—C. W. Burton, Griffiths & Co., London, England. Germany—E. Sonnenthal, Jr., Berlin.

It Keeps Tight.

This Crosby Blow-Off Valve keeps tight. Just that one point has made it one of the most popular blow-off valves there is. It works easily—doesn't take two men to open or close it. It was invented by Mr. Samuel G. Reed, M. E., after a careful study of the difficulties which usually surround the use of valves of this class.

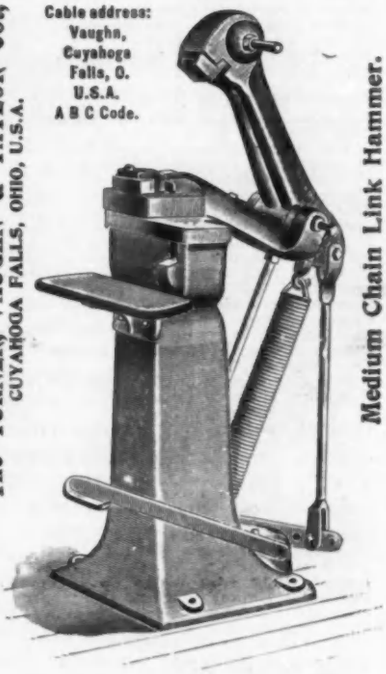
It embodies all the good features of other straight-way blow-off valves, contains none of their weaknesses, and has many good points that are peculiar to itself.

Descriptive circulars of this and our other high-grade products, free.

Crosby Steam Gauge & Valve Co.,
Office and Works, BOSTON, MASS.
93-97 Oliver Street, Boston, Mass.
78 John Street, New York.
21 and 23 W. Lake Street, Chicago.
75 Queen Victoria Street, London.

The TURNER, VAUGHN & TAYLOR CO., CUYAHOGA FALLS, OHIO, U.S.A.

Cable address: Vaughn, Cuyahoga Falls, O. U.S.A. A B C Code.



Medium Chain Link Hammer.

R. POOLE & SON CO.,
ENGINEERS, FOUNDERS AND MACHINISTS,
BALTIMORE, MD.
MANUFACTURERS AND DESIGNERS OF ALL KINDS OF
HEAVY MACHINERY,
REQUIRING FIRST CLASS WORKMANSHIP AND MATERIALS.
BAND AND ROPE FLY WHEELS. FRICTION CLUTCHES. PULLEYS. SHAFTING AND HANGERS.
MACHINE MOLDED AND PLANED GEARING.
POOLE-LEFFEL TURBINE WATER-WHEELS.
CIRCULARS ON APPLICATION.

Quint's Turret Drills,

For Drilling and Tapping, are made with from Four to Twelve Spindles.

A. D. QUINT, 3 Clinton St., Hartford, Conn.

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AMERICAN MACHINIST

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The Champion Scrapper.

The practical retirement from business of Andrew Carnegie is an event which it is impossible to allow to pass without notice. He has been a most prominent figure, if not the most prominent, in the phenomenal development of the iron and steel industries of the United States, and his advanced and aggressive methods have done much to bring us to successfully cope with the competing manufacturers of the world. He secured a rapid and enormous success, both for himself personally and for the business of which he was so long the leading spirit.

The event of Carnegie's retirement suggests many lines of remark which have been, and will be, sufficiently exploited by others. He, of course, will not be known to posterity as an engineer, but as a pushing business man. Aside from his native ability, opportunity favored him. He went into the business just when its rapid growth was inevitable. At the close of the civil war the consuming capacity of the country grew with astonishing rapidity. The days upon which he fell were the days also of the most revolutionary discoveries and the most pronounced changes in the processes of iron and steel manufacture, and it was in the immediate adoption of each improvement that his success was secured. He kept his competitors on the run, and usually kept ahead of them. The successive adoption of the new involved the abandonment and destruction of the old, and this was done heroically and persistently. He has been, as we here venture to characterize him, the champion scrapper, meaning, of course, the maker of scrap. He made scrap of anything and everything, no matter what it had cost, without hesitation or delay, the moment it was possible to supersede it with something in which there was more profit. Perhaps no lesson is more needed by the average manufacturer than this which is enforced by Carnegie's success. He believed in compound profits or in profits upon profits. Instead of pursuing the more prudent course of withdrawing and securing the profits that were assured they were continually invested in enlargements, improvements and reconstructions. He was always looking for the cheapening of production and the enlargement of output, and whatever stood in his way was removed and discarded, no matter how much it may have cost nor how much of a revolution in methods was involved in the change. He retained no machine or method for what it had done, but considered only present or potential efficiency.

The Operation of Automobiles.

On Memorial Day an "American Machinist" man happened to witness the quick collapse and apparently almost complete dismemberment of an electric automobile in New York. The "engineer" undertook to turn a corner at a rapid rate and apparently started to turn too late. He put his helm hard up, but the radius of evolution was too great for the available room, and striking the curb a glancing blow, the suspension wheels collapsed and settled down; one axle broke and the vehicle was practically a unanimous wreck.

The incident is typical of many similar and perhaps more serious ones that must occur, and indicates a line of education that must be followed by the public before this new implement can be handled with safety, either for those who ride in them or those who travel by other means.

It will probably be necessary to regulate the speed of such vehicles in city streets, to prescribe by ordinance the manner and the method of turning corners, and perhaps to take some means of ensuring that absolutely inexperienced and incompetent persons are not allowed to imperil themselves and others by the use of them.

Some degree of natural coolness and self-control, presence of mind and nerve will be required to operate these vehicles in crowded urban streets, and besides these there should be enough of preliminary training to render an operator thoroughly familiar with the handling of his machine, so that the proper movements to control it will have become something like second nature.

Long Service Appreciated.

The following resolution was adopted by the directors of the New York Central Railroad upon the retirement of Mr. William Buchanan, superintendent of motive power and rolling stock, after continuous service with the company of fifty-two years:

"For more than a quarter of a century Mr. Buchanan has been the recognized leader among the railroad men of the United States in his specialty. Many of the remarkable improvements in the power of locomotives and their ability to haul increasing weight of trains have been his suggestions, and all of them are the result of expert and able sifting of hundreds of inventions at his hands. The railroads owe much to him for those reductions in the cost of operation by which they have been enabled to survive the constant lowering of rates.

"He never had any difficulties with the engineers or firemen, but retained through all the labor troubles which occurred during his long service as superintendent of motive power the loyalty, friendship and cordial support of every man subject to his authority. He has enjoyed the absolute confidence of every administration, and it has been the pleasure of each president to bear testimony to his successor to the intelligence, integrity and great value to the company, in the shops and on the road, of this upright and able officer. He carries with him in his retirement the friendship of us all, and our best wishes for the full enjoyment of many years of health and happiness."

This testimonial is, we believe, fully deserved, but at the same time it must be said that Mr. Buchanan was far from the ideal chief mechanical officer of an important railroad. He knew practically nothing of the art of putting responsibility

upon the shoulders of others and of giving them full play for their abilities within the bounds of their responsibilities.

There have been and are many others who know a good deal of railway motive power, but no such man could render any assistance whatever to Mr. Buchanan, simply because he would not allow it. Neither Buchanan nor any other man connected with the mechanical department of the road belonged to or took any part in the proceedings of the Master Mechanics' Association or any of the railway clubs. "Sufficient unto its needs is the mechanical department of the New York Central Railroad" seemed to be the motto which governed his conduct, and in this it is our belief he made a serious mistake, notwithstanding the degree of success which he attained, and for which success he deserves of course full credit, regardless of the plain fact that he would have been still more successful if in addition to his other talents he had possessed the faculty of gathering about him and retaining the services of efficient lieutenants, and had shown more appreciation of the fact that things were to be learned by association with others in the same line of business and engaged in the solution of the same problems.

Needed Improvements in the Patent Office.

Not the least important action taken by the American Society of Mechanical Engineers at the annual meeting recently held in Washington was the adoption of resolutions directing its members to urge upon Congress the necessity for relieving the present overcrowded condition of the Patent Office and providing sufficient room, force and facilities for the prompt and proper execution of its work. It is a cause for congratulation to all interested in our patent system when such a distinguished body of men thus strongly express themselves. Their action is indicative of the very strong sentiment now existing among those who keep abreast of the times, that whatever is needed to keep the American patent system at the front should be promptly and cheerfully granted by Congress. Every intelligent man, watching the increase of our exports of manufactured goods, readily admits the debt owed to the patent system.

The most pressing need of the Patent Office is for additional room. With a commodious building the present working force of the office would be enabled to promptly do its work. Many of the records are inaccessible, and by reason of the lack of sufficient space so arranged that it requires double the time it ought to find them. Furthermore, a fireproof structure should be erected in which to store those records which cannot be replaced. The legal title to many millions of dollars of property would be jeopardized by the destruction of the assignment records, for many of the original assignments have been lost by their owners, who depend upon copies certified by the Patent Office. These improvements would not be a tax on the public, for the Patent Office receives more money annually than it pays out, and is in fact self-supporting.

It is gratifying to note the interest now being taken by scientific and trade organizations in the efforts made to keep the Patent Office, one of the most important branches of the Government service, abreast of the progress in the mechanical and manufacturing arts. The machinery industry is vastly interested in the work of the Patent Office and should heartily second any movement calculated to improve its efficiency. A. F. T.

Compressed Air to Ring the Bells of St. Patrick's.

In the north steeple of the west front of St. Patrick's Cathedral, of this city, hangs a chime of bells well worthy of the magnificent edifice. There are nineteen bells, ranging in weight from 7,000 to 300 pounds. They are from the celebrated bell foundry of Messrs. Paccard, in Savoy, France, and have been in position a couple of years; but until now no means have been provided for ringing them. It was recognized that for this service compressed air is eminently adapted, and Mr. Hartford C. Champ, of Brooklyn, has devised and installed the mechanism for the purpose.

The air compressor is placed in the basement of the eastern end of the building. It is an 8x8-inch Ingersoll-Sergeant horizontal, double-acting, single-stage machine, with a normal speed of 150 rotations per minute. It is driven by a Lundell motor, which is geared to it with a speed ratio of 5 to 1. The current for the motor is from the lines of the Edison Company. The motor has a sufficient torque to be depended upon to start the compressor under a pressure of 35 pounds, and will compress to 80 pounds or over. Electrical connection with the gage upon the air receiver makes the action of the compressor perfectly automatic, so that it stops and starts itself without the slightest supervision. A vertical air receiver is placed near the compressor, and the air is conveyed by a 2-inch pipe to the belfry, where another receiver is placed. There is also an intermediate receiver, so that a large air storage capacity is provided. A pressure reducer maintains a constant pressure in the belfry. The air-compressing plant, as it embraced no actual novelty and involved no experimenting, is entirely satisfactory and suggests no criticism.

The actual striking of the bells at command, however, involved some unusual conditions, and required new mechanism throughout. The bells are hung around the belfry in two tiers, the larger ones of course below and the smaller and more numerous above. The lower edges of the bells of each tier are not all of the same hight. A system of steel I-beams has been provided for the horizontal air cylinders, one of which is connected to the tongue of each bell, the cylinders being thus held very firmly, while it must be confessed that the bells are not, these being suspended from horizontal timbers, and swinging away from the blow quite an appreciable distance. The cylinders for the larger bells are 4⅜ inches diameter; those of the next size are 3 inches, and the smaller ones are 2 inches. The clappers of all the bells are double, the two hammers balancing each other, and each hanging so that much less movement is required for striking than when a single tongue is used. The combined weight and momentum of the double hammer is of course much greater than that of a single one usually is. The piston rod of the air cylinder is attached to a central stud projecting below the center of the clapper. The air pressure is used only behind the piston for making the stroke, the weight of the clapper aiding to bring the piston back, and a spiral push spring in front of the piston being provided also. When seen in operation the air seemed to be discharged from behind the piston after the stroke too slowly; but this, of course, is easily remedied by enlarging the exhaust passages.

The bells are to be operated from a key-board placed in the sacristy of the cathedral. A key similar to and not larger than a piano key is provided for each bell and connected to a battery and to an electro magnet at the bell. A depression of the key completes the circuit, a little piston valve is moved a sufficient distance to admit the air to a larger valve, and this in turn operates the piston and strikes the bell. There can be little doubt of the ultimate success of the apparatus, and the ringing of the bells of St. Patrick's may soon become another permanent feature of the metropolis.

Paris Exposition Plans.

Following the conferences of tool builders, which were held under the auspices of the United States Commission for the Paris Exposition, to discuss arrangements for exhibiting their machinery to the best advantage, and a report of which was given in our last issue, an informal meeting of several parties who had been present at the New York conference took place May 25 at the works of the Brown & Sharpe Manufacturing Company, Providence, R. I. Those present were for the most part New Englanders. The prospects for the Paris Exposition had seemed unfavorable, and to judge of them better it was thought that a friendly discussion of the situation would help all concerned. The meeting resulted in a unanimous determination to exhibit at Paris, notwithstanding the somewhat re-

stricted opportunities which were offered. It is believed that the Commission have succeeded in solving the problem presented them, and that the new building will contain an adequate representation of American machinery.

The American Commissioner General has called a meeting of directors of all departments, to be held in New York, June 12, to consider details relating to the exhibits. No doubt some more definite action bearing upon the plans of the machinery exhibitors will then be taken.

Machinery manufacturers have already begun to formulate definite plans as to the character of their exhibits. The Webster Manufacturing Company, for instance, proposes to show a complete working model of a grain elevator on the scale of one inch to the foot.

Commercial Review.

NEW YORK, SATURDAY EVENING,
June 3, 1899.

MACHINE TOOLS.

The mystery of the reported *rapprochement* of the Niles Tool Works Company and Bement, Miles & Co. remains unsolved. Notwithstanding the refusals of parties interested to confirm the news, there is a strong disposition in machine-tool circles to regard the affair as other than mythical, and some of these opinions are based upon authority. But even if these two concerns should unite, we are not to expect that they will have a monopoly of the heavy tool trade. Information has come from a semi-official source that the American Tool Works Company seriously contemplates the erection of a large new plant for the construction of tools of all kinds, including, unquestionably, such of the bigger tools for locomotive work and the like as it does not now build. The company has secured the refusal of 50 or 100 acres of land upon the outskirts of Cincinnati, and indeed may already have purchased it. There it is proposed to erect a factory which will be the largest single machine tool building plant in the country and especially will be equipped with the highest possible perfection of modern appliances. The company is said now to have a large amount of capital behind it, so that it is able to carry out its plans, and one or two of the heaviest stockholders are stated to have expressed themselves enthusiastically in favor of the scheme. The project was formed irrespective of the Niles-Bement-Miles deal, and is none the less likely to be carried into effect if the latter proves true. The American Tool Works Company has now 750 men employed, including those who are working upon such of its work as has been put into outside plants.

No sharp reaction from the extensive tool-buying which characterized the winter and early spring has yet arrived. While some sellers report a slight tapering off in trade, those who do not find any decrease are no small percentage of the whole number. Prices have obtained practically a steady basis. Deliveries, though in some cases growing slightly easier, partly because of increased manufacturing facilities, are more generally becoming harder to obtain in a reasonable time, particularly on heavy tools. Here are specimens: A local dealer has placed a stock order for a 54-inch by 25-foot lathe, weighing 25,000 pounds or over, which is not promised in less than six months, although he thinks he may receive it a little earier. By another selling house a lot of miscellaneous tools, such as planers and lathes, have just been ordered for November delivery. Some of these have already been taken up by consumers.

European trade is reported still excellent. A buyer for a large German house informs us that the demand from that country for last month held its own well as a whole. For the time being there was less demand for ordinary engine lathes and for milling machines, but this was compensated for by the call for other lines of tools, particularly planers and Gisholt lathes. A local company which has a German store tells us that it is getting about as many orders from that country this year as last, but has to work harder to secure them.

The present active demand for American machinery to go to France is accounted for by the extraordinary engineering work for the coming Exposition. Every mill and machine shop there is said to be rushed to its utmost capacity in executing contracts connected with the fair.

Froeligh & Morgan, Park Row Building, New York, are placing contracts for the machinery equipment of a factory at Sunbury, Pa., where they will manufacture hardware specialties and magazine rifles. The machine tool plant will comprise thirty-five to forty machines, including among others lathes of 16 inches and under, turret machines, and a forging plant with hammers up to 1,000 pounds in size. A 30 horse-power engine and 50 horse-power boiler for the plant have been purchased of Olney & Warrin.

The M. S. Friede Company, New York, which in the past has been a heavy purchaser of supplies for the Trans-Siberian Railway, is now placing orders for a large quantity of tools for railways in Japan, China, etc. Contracts for about $20,000 worth of track tools in this connection have already been let. The machine tool contracts, which will probably amount to much more, have not all been fully closed, but we may be able to report them in our next number.

A machine shop tool equipment for the Odawara Electric Railway Company, Odawara, Japan, was shipped in the spring by the Peckham Motor Truck and Wheel Company. It included a 150-ton hydraulic press, a car-wheel borer, a 20-inch stroke shaper, a double-head car wheel grinder, some lathes, pneumatic hoists, etc.

MISCELLANEOUS.

The American Gas Furnace Company, among recent installations, has placed one of its oil gas machines in the United States Mint, Philadelphia, Pa., and another in the factory of the American Waltham Watch Company, Waltham, Mass. The machine placed in the mint supplies fuel gas for the assaying department, annealing room, and for the engraving department, for annealing the blanks and hardening coining dies. In the new mint now being erected the company expects to install its gas system for all the work to be performed.

The Chambersburg Engineering Company, Chambersburg, Pa., is very busy at present, having under construction a 6-ton hammer for the Duquesne Forge Company, a 3-ton hammer for a New York dealer, and several smaller hammers ranging from 600 to 2,000 pounds. They are also equipping a number of hydraulic riveting plants, having just recently completed a shipment of five 100-inch hydraulic riveters, of their new and improved type, to the Schoen Pressed Steel Company's shops at McKees Rocks, Pa.

The Bullock Electric Manufacturing Company, Cincinnati, Ohio, although installed in a factory with treble the capacity of the former one, finds it very difficult to fill orders. The pressure will shortly be relieved by the arrival of numerous special new tools which have been delayed owing to the crowded condition of the tool factories. The company's type "N" slow-speed motor, adapted to direct connected driving of tools and other machinery, is receiving much notice in this country and elsewhere.

The J. A. Fay & Egan Company, Cincinnati, is reported to have received an order for $50,000 worth of machinery for a saw and planing mill to be erected near Quebec, Canada, by Miller & McCromby, of Montrose, Scotland. The cost of the entire undertaking is estimated to exceed $500,000.

The Japanese Government is expected shortly to enter this market for material for docks and harbor improvement and railroad extension in Formosa. European competition will probably be considered.

The New York Central Railroad contemplates the erection of a 3,000,000-bushel grain elevator at Weehawken, N. J., the terminal of the West Shore Railroad, which the Central controls. It has been decided who shall furnish the steel building and who the machinery equipment if the scheme is carried out. The machinery contract may be let next week.

EXPORTS OF AGRICULTURAL MACHINERY.

Russia is a large buyer of American agricultural machinery this season. The Ministry of Agriculture, in order to im-

prove agricultural conditions in the Trans-Caucasus district, has ordered the Agricultural Company of the Caucasus to devise means for the introduction of more modern implements and machinery. The Ministry has voted a contribution toward the cost of opening depots in that region for the cheap sale of implements. It is already well known that the Russian duty on agricultural implements and machinery has been removed for the present.

A correspondent of the Philadelphia Commercial Museum from Bangkok, Siam, writes that there is a field there for some special agricultural implements. He says in part: "Perhaps a large, strong tool, something like our spring tooth cultivating harrow, could be used as a great improvement on the present stirring of the ground with a stick and punching it with the wallowing of the Buffalo herd. This could be made to ride the soil very well, but would not turn the surface under. The need is a plow."

Seventy-seven carloads of Peoria harvesters are understood to be *en route* to Argentine Republic. This is one of the largest orders for agricultural machinery that has ever come from South America. The Johnston Harvester Company, Batavia, N. Y., not long since shipped twenty-one carloads of harvesting machinery to Russia and France. The W. A. Wood Mowing and Reaping Machine Company, Hoosick Falls, N. Y., are making an especially heavy shipment to France. Exports of that company for April aggregated nearly a quarter of a million dollars.

CHICAGO MACHINERY MARKET.

A maker of Corliss engines remarks that the conditions now prevailing in the West are making the sale of his products quite easy. There is an increasing percentage of power that is required to be in operation for twenty-four hours a day, or for a longer period than the usual ten hours. The question of fuel consumption is therefore a more vital question. For both boilers and engines the present demand is fully as great as it has been at any time within the past year. For the moment there may be a little less inquiry for large engine capacity, but even that estimate of some makers is not corroborated by other makers. There are now under negotiation a number of large contracts which ordinarily would have been closed up in May, but which, on account of the difficulty of making deliveries, have gone over to the present month. This delay has made the May business less active in its totals of the large trade than was April, but the business that is now in sight for speedy termination is greater than that standing open a month ago. The inquiry is mainly for electric lighting, electric railway, steam railroad and packing plants, and calls in the aggregate for a very heavy capacity of power.

For engines and boilers of small power the demand is not quite so large. This is a common report, but when inquiry is made as to the activity of the factories the response is invariably that they are working overtime. Engines are increasing steadily in value, but more slowly than boilers, which have had an advance of fully 33 per cent. Orders for small standard engines can be filled with a reasonable degree of promptness, but for anything outside of the ordinary the matter of time is more difficult to handle satisfactorily. While engine builders are getting from the steel works the castings for their regular sizes with fair promptness, if they ask for special sizes the reply is that the castings can be made in from three to six months, and the time limit is usually nearer the latter than the former figure. Again, special work often has to go through the drafting room, which is so overcrowded with work that long delays are unavoidable. Boiler plates and tubes are both scarce and higher in value. For deliveries next February some of the makers of the former are making slight concessions from the extremely high prices that have been prevailing.

The Fraser & Chalmers Company has a very active trade in engines and boilers for mining operations. Activity is especially noticeable in the copper mining regions of the lakes and in the Rocky Mountains, where a large number of new companies are starting in business.

The Western office of the Babcock & Wilcox Company has sold a much larger power during the first five months of this year than in the corresponding period of 1898. Last year was their best on record.

Among recent orders of A. L. Ide & Sons was their third engine to the Siegel Cooper Company, of this city, one of 250 horse-power.

PITTSBURGH REPORT.

The present condition of trade in the Pittsburgh district is too much on the order of "rush." While manufacturers of all kinds of material are accustomed to busy spells, still they are not particularly in love with existing conditions. They are too busy to be comfortable and are turning down orders with a marked degree of regularity. The market is too healthy, and there is some fear expressed that a breakdown is bound to come at some future time. This may not occur until after the close of the present year, but persons are certain it will come.

High prices have no effect upon the buyer, who seems to think that he cannot afford to wait for lower figures. Inquiries are thick with each mail, and when these conditions are to cease is a puzzling question. Pig iron is scarce, chiefly because of the immense demand and the lateness of opening up of lake navigation. In the mining regions, explorations have never been so heavy.

In the machinery equipment line, particularly engines, builders are overcrowded and feel inclined to lay back for the next two or three months. During the past few weeks the Nordberg Manufacturing Company sold two large engines to be installed at a new seamless tube plant to be located at Ellwood City, Pa. The Bass Foundry & Machine Company will install a heavy engine at the Atlantic Tube Company's works at Beaver Falls, Pa., while the Atlas Engine Works will furnish the Severance Bolt Works, Glassport, Pa., with one of its latest type engines.

The mill supply people are enjoying a brisk business and would do a great deal more if manufacturers only had a little time to shut down. Repairs are being made constantly, but these are of piece to piece order, instead of the mills getting a good overhauling, which is needed.

Structural builders have all they can take care of. The Shiffler Bridge Company, Riter-Conley Manufacturing Company and the Pittsburgh Bridge Company are running night and day. Many new plants are under course of construction and still others are contemplated.

Quotations.

NEW YORK, Monday, June 5.

Iron — American pig, tidewater delivery:—

Pennsylvania irons:

No. 1 X foundry	$17 00 @ 17 50
No. 2 X foundry	16 50 @ 17 00
No. 2 plain	16 00 @ 16 50
Gray forge	15 50 @ 16 00

Alabama irons:

No. 1 foundry	16 50 @ 17 25
No. 2 foundry	16 25 @ 16 75
No. 3 foundry	15 75 @ 16 25
No. 1 soft	16 50 @ 17 25
No. 2 soft	16 25 @ 16 75
Foundry forge	15 00 @ 15 75

Bar Iron—Refined: Mill price in carloads on dock, 1.80c., upward; from store, 2.00c., upward. Common, from store, 1.90c.

Tool Steel — Base Sizes — Standard quality, 7 @ 8c.; extra grades, 12 @ 14c.; special grades, 16c., and upward.

Machinery Steel — Ordinary brands, from store, in small lots, 2.30c., upward.

Cold Rolled Steel Shafting—Base Sizes, from store, in small lots, 3¼c.

Copper—Carload lots, Lake Superior ingot, 18 @ 18½c.; electrolytic, 17¼ @ 17½c.; casting copper, 17 @ 17¼c.

Pig Lead—Carload lots, 4.45 @ 4.47½c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 25¾c., f. o. b. New York.

Spelter—Prime Western, in carload lots, 6½ @ 6¾c., New York delivery.

Antimony—In cask lots and over, Cookson's, 11c.; Hallett's 9⅞ @ 10c.

Lard Oil—Prime city, ice pressed, 42 @ 44c. for the leading brand, in wholesale lots.

An Automatic Screw Machine.

We give on this and succeeding pages engravings showing the general appearance and construction of a recently perfected automatic screw machine which is being made by the Brown & Sharpe Manufacturing Company, of Providence, R. I.

In the design of this machine it has been made an object to accelerate, so far as possible, all those functions involved in operations other than the actual removal of chips and to arrange for the performance of these functions at a uniform speed not dependent upon the speed at which the main spindle may be running.

Owing to the necessity for providing for a reverse motion of the spindle, clutch pulleys are placed upon it, and six changes of speed are provided by the arrangement of countershafts shown in Fig. 2, where, as will be seen, the spindle speed may be changed to any rate desired without altering the speed of a pulley seen at the extreme left of the machine; this pulley being upon the end of a shaft which runs along at the rear of the machine and from which the motions for the previously referred to changing functions are derived. This shaft is seen at *a* in the rear view of the machine, Fig. 4. Near its left-hand end are change gears through which it drives the worm shaft *b*, and from this a cross shaft is driven which, in turn, by means of miter gears, drives the shaft which runs along the front of the bed and is shown in Fig. 3, at *c*. From these two longitudinal shafts the rear one driven at a constant speed and the front one at a speed depending upon what change gears are used, but both of them independent of the spindle speed, the various motions are derived.

At Fig. 3 is given a section of the spindle and boxes with the clutch mechanism for reversing. The spindle is of steel, hardened and ground, runs in phosphor-bronze boxes, to which it is lapped, and the clutch pulleys are bushed with phosphor-bronze and run upon a hardened and ground portion of the spindle. They are oiled by means of loose rings running over the spindle within a chamber provided for the purpose at the center of the pulleys, as shown, thus forming an oil reservoir.

The chuck, which is of the split collet variety, abuts against a square shoulder when it is tightened up, and thus variations in length of pieces due to slight variations in size of stock are avoided.

The chuck is closed by means of a sleeve which is tapered internally at the outer end and incloses the collet as shown, extending back into the spindle a little past the rear end of the front bearing, where it meets a sleeve passing through the spindle to the rear, which spindle is acted upon by the chuck levers *d*. Inside this sleeve is still another sleeve, called the feed tube, through which the stock passes to the chuck, and this sleeve is given at the proper times a reciprocating motion to feed the stock forward through the chuck; its grip upon the stock being a frictional one by means of spring fingers formed in a second split collet screwed to the end of this tube, and lying within the chuck collet as shown. It is moved back when the chuck is closed, slipping over the stock, and moves forward when the chuck is open, carrying the stock with it. The motions for operating the clutch and for feeding the stock as well, are taken from the cam *e*, Fig. 3.

In the rear view, Fig. 4, is seen the upper end of the lever which throws the clutch on the spindle. The spindle is reversed to run backwards by the spring plunger *f*, which, when released, is moved by its spring to engage the clutch nearest the chuck. The clutch is moved the other way—i. e., to run forward by the cam *g*. This cam is operated by the clutch *h*, and when after engagement it has made one revolution, the clutch is thrown out by the lever *i*, Figs. 3 and 4; this lever being operated by one or more dogs set on a disk on a shaft *j*, which is in front of the machine. At the time of reversing the spindle to run forward, the action of the cam compresses the plunger spring ready for the next reversal. The plunger is held in place by the wide part of the lever *k*, Figs. 3 and 4. The levers *i* and *k* are lifted to reverse the spindle at the proper time by adjustable dogs on the carrier shown below them in Fig. 3. If the work is to be threaded, this carrier shaft is connected by the positive clutch to the cut-off cam shaft *c*, Fig. 1. Should it be desired to both thread and tap the work or to cut two threads on one piece, two or more sets of dogs may be placed upon the carrier.

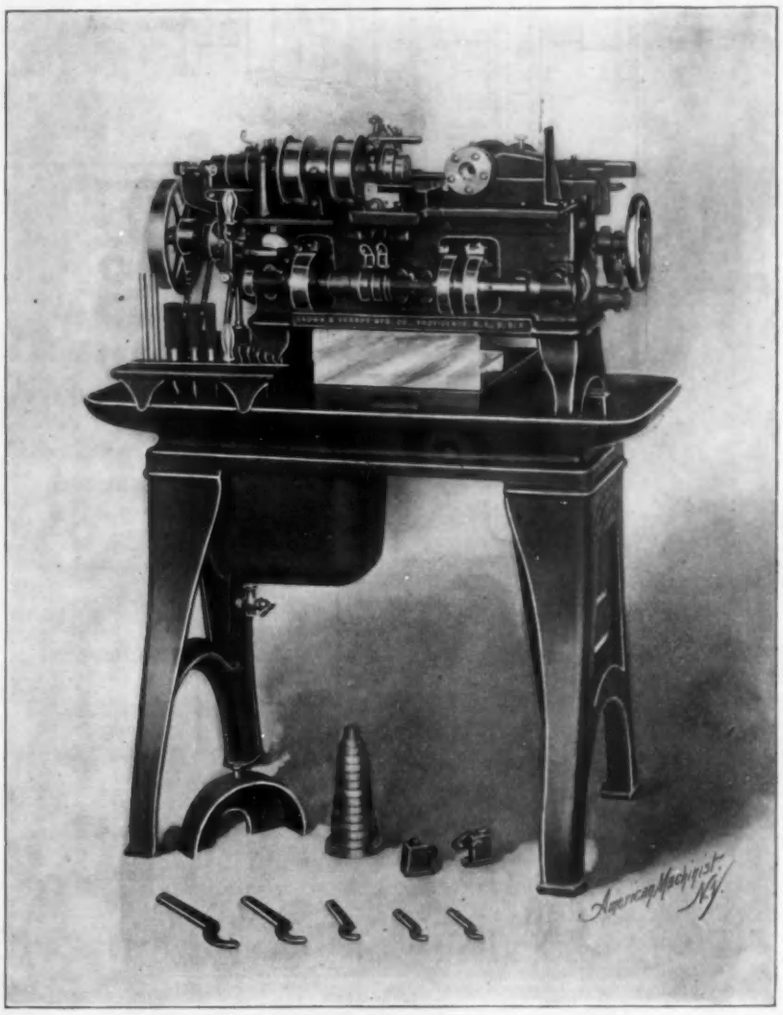


FIG. 1. BROWN & SHARPE AUTOMATIC SCREW MACHINE.

The main feed shaft (*a*, Fig. 4) is driven by the pulley at the right, as before stated, but by means of a clutch controlled by the vertical lever *l*, Fig. 3, by means of which the feed may be thrown in or stopped by the operator. From the cam *e* the lever *m* is operated, and the upper arm of this lever is fitted with a sliding block moved to any required position by means of a screw and the crank-handle seen at the top of *m*. From the block there is a connection to the feed tube previously described as passing

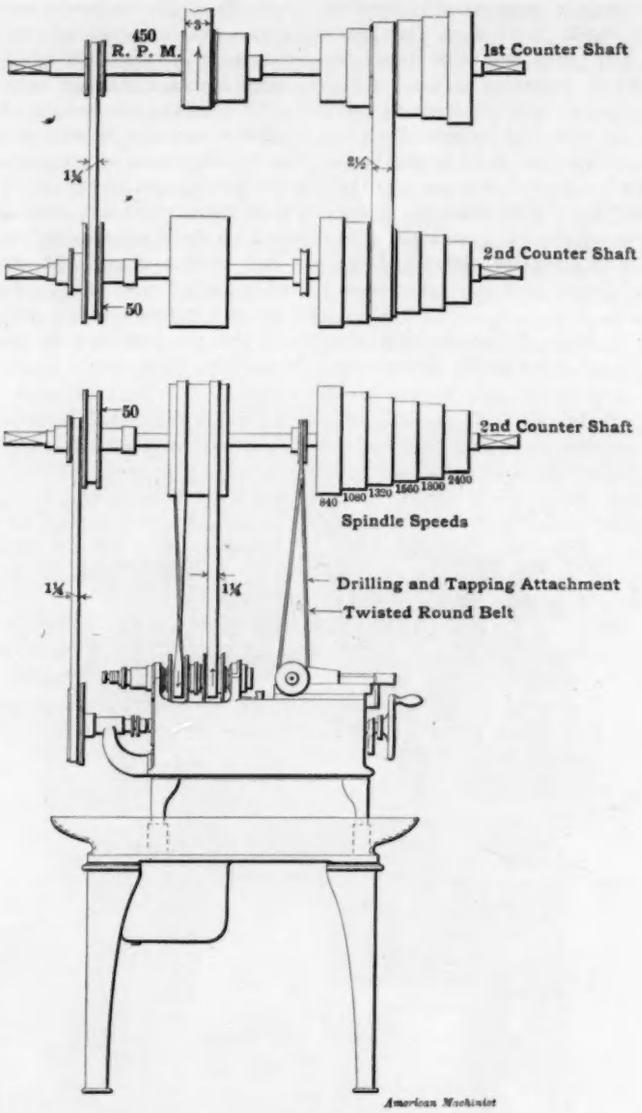


Fig. 2

PLAN AND ELEVATION OF OVERHEAD WORKS.

through the spindle, and this tube is given any desired amount of motion up to 2 inches, depending upon the position of the sliding block. A graduated scale indicates to the operator the length of feed for which the block is set. When it is desired to feed stock more than 2 inches, two or more dogs may be set on the left side of the carrier *n*, Fig. 3, thus operating the feeding mechanism two or more times.

The turret has holes ⅝ inch diameter, and is mounted on a vertical axis at the side of the turret slide instead of on top of it, as usual. It is rotated by a hardened roll in the disk *o*, Fig. 4, that engages the radial grooves in the disk *p*, which is on the end of a cross shaft which at the other end carries the turret. The revolutions of the turret are thus made very rapidly, and without appreciable shock or noise. The turret is locked in position by the hardened taper pin shown in Fig. 5, this pin being withdrawn by the cam and lever shown.

The turret slide receives its forward motion for the cutting tools through a bell-crank lever operated by a cam on the shaft *q*, Figs. 4 and 6, which is driven from the worm shaft parallel with it by means of spur gears. The quick return and advance of the turret slide and the rotation of the turret are controlled independently of the turret slide feeding motion by the crank *r*, Fig. 7. While the roll on the bell-crank lever seen below in Fig. 7 is passing from the highest point of the turret slide feed cam to the point of starting the next cut, the crank *r* is operated by gears at the rear of the machine driven by a positive clutch from the shaft *a* by mechanism like that described for the feed. As the crank *r* revolves, it allows the spring shown below it to return the turret slide without the rack. The turret is then revolved as described, and when the crank comes to rest after making one complete revolution, the machine is ready for the next operation. The rod *s*

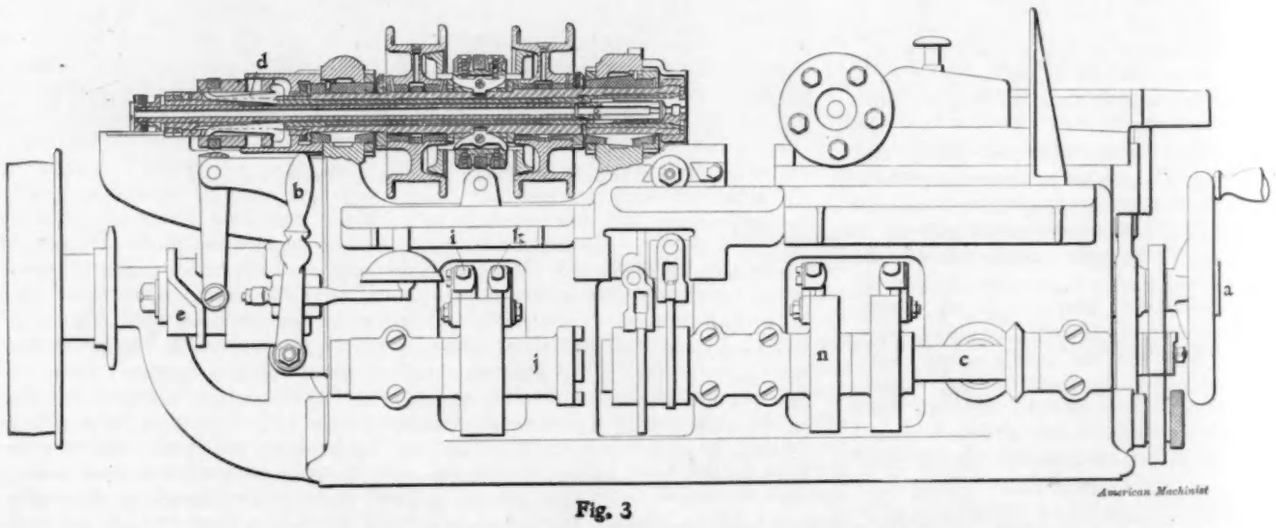


Fig. 3

FRONT ELEVATION OF AUTOMATIC SCREW MACHINE, WITH SECTION OF SPINDLE AND BEARINGS.

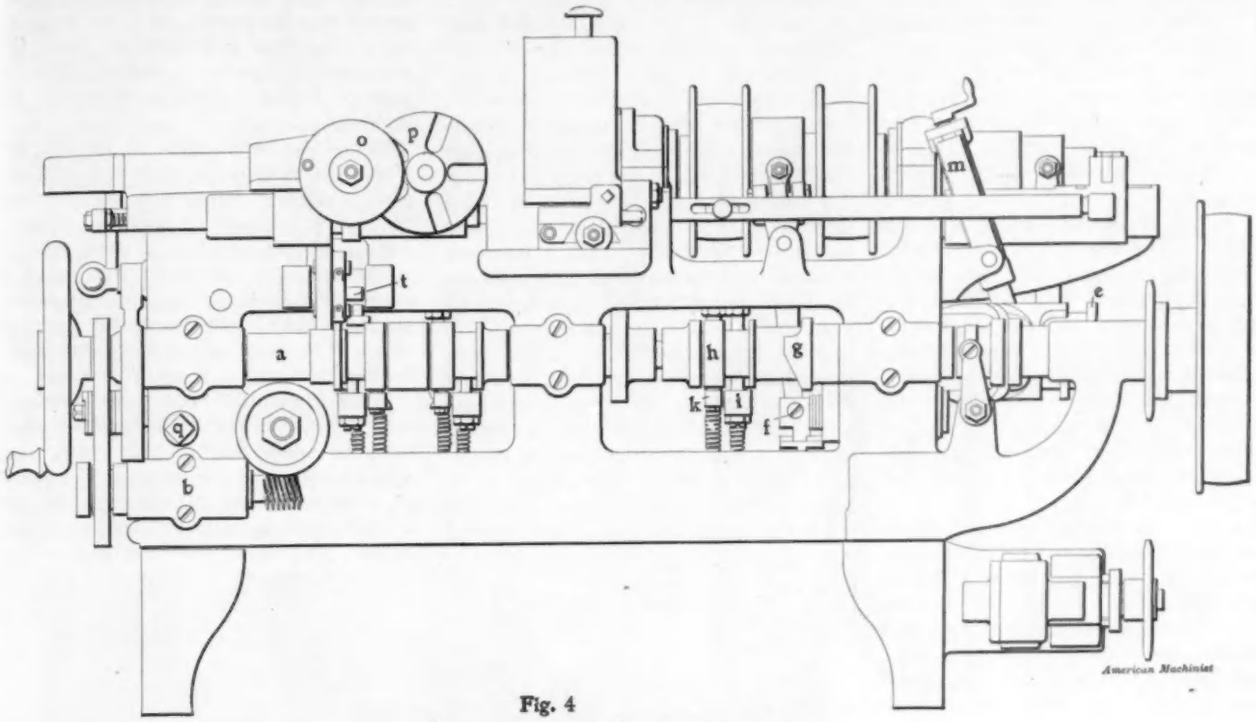


Fig. 4

REAR ELEVATION OF AUTOMATIC SCREW MACHINE.

attached to the crank makes it certain that the turret slide will be returned should the spring be unable to do it, owing to binding of the tools or from any other cause.

The intermediate gear is provided with five pins, corresponding to the number of holes in the turret; and when less than five tools are in use one or more of these pins are pushed out to depress the tripping lever, thus allowing the turret to revolve without stopping. As shown in Fig. 4, for instance, pin *t* is pushed out and the turret will not be stopped when it arrives at the position corresponding to this pin, but will pass on to the next hole. The pins and the turret holes are numbered to correspond.

The cross-slides are operated by the cut-off cam shaft *c*, Figs. 3 and 8. The

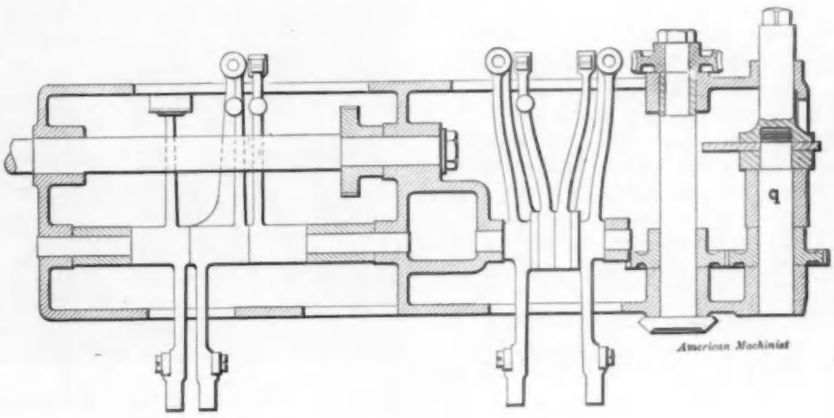


Fig. 6

PLAN SHOWING FEED SHAFT, TRIPPING LEVERS, ETC.

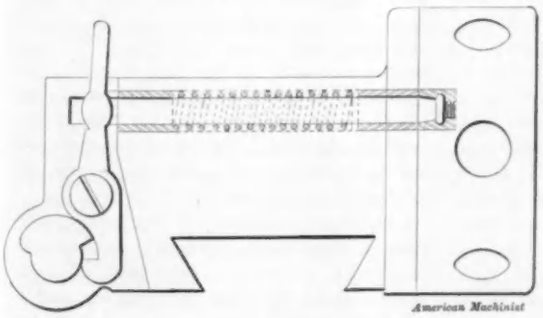


Fig. 5

END VIEW, SHOWING LOCKING PIN FOR TURRET.

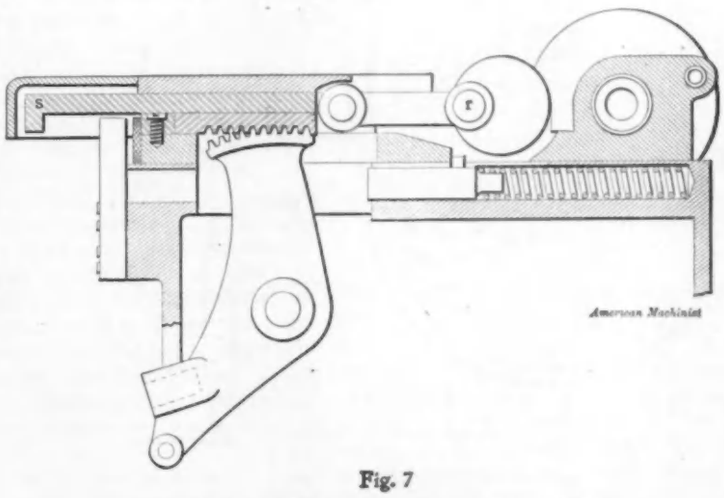


Fig. 7

SECTION SHOWING OPERATION OF TURRET SLIDE.

front slide has a direct lever or gear segment, and the rear one an intermediate, by which the motion is reversed, thus bringing both cams into convenient

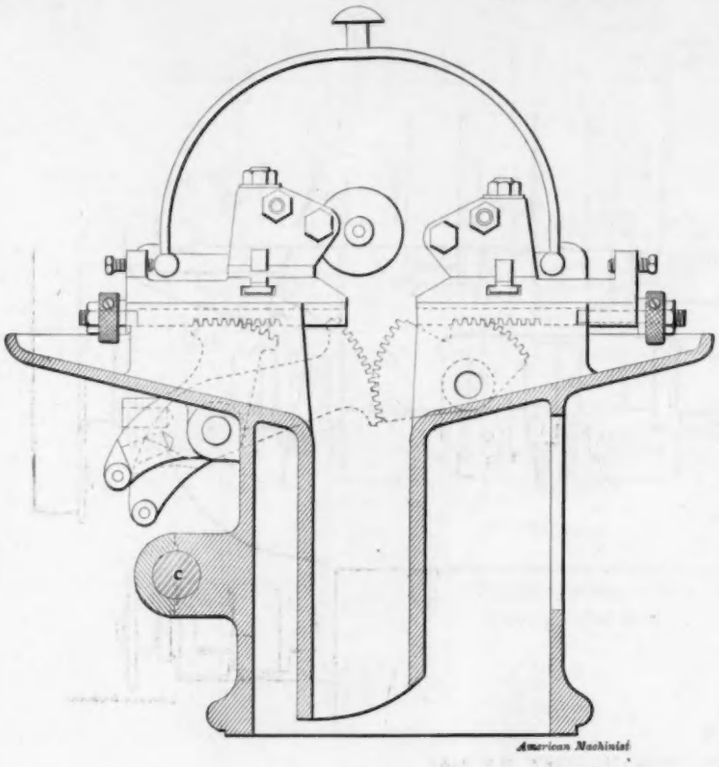


Fig. 8

SECTION SHOWING ARRANGEMENT OF CROSS SLIDES.

position, and the form of that portion of the cams which controls the quick motion of the slide is the same for both.

As will be seen the segments engage with racks which extend out beyond the slide and are provided with nuts for adjusting the exact position of the tools; in addition to which there are positive stops to insure accuracy in forming-tool cuts.

The machine is provided with a deflector, shown in Fig. 9, by which the chips are separated from the work. The deflector *u* is at the end of a lever which is moved at the proper time to bring it under the chute and carry the piece of work into a separate receptacle. This is done by a dog located on a carrier, as shown.

It will be noted that all handles by which the machine is controlled and all parts requiring adjustment in "setting up" for a job are conveniently located, and in fact, the machine as here shown, is the result of successive improvements made from time to time, as experience suggested their possibility, during a period of use in the maker's and other shops, extending over a term of about ten years.

What is essentially the same machine, but in simpler form, is supplied for threaded work that is quite short and where turret tools are not needed. In this case the turret and slide are replaced by a plain slide, suitable for holding a tap or die. In another form the machine retains the turret and slide as described, but is provided with a four-step cone pulley on the spindle. This machine does not reverse and is designed for work not threaded or tapped.

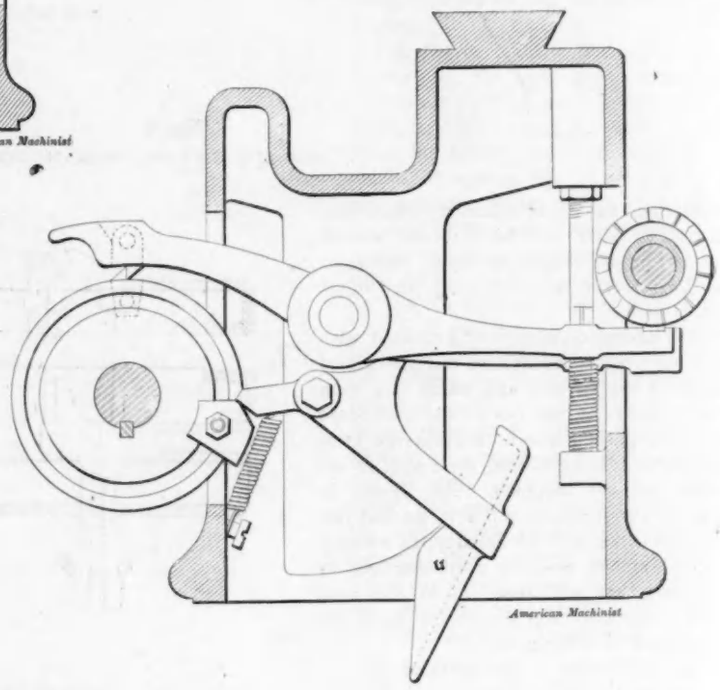


Fig. 9

SECTION SHOWING ARRANGEMENT OF DEFLECTOR.

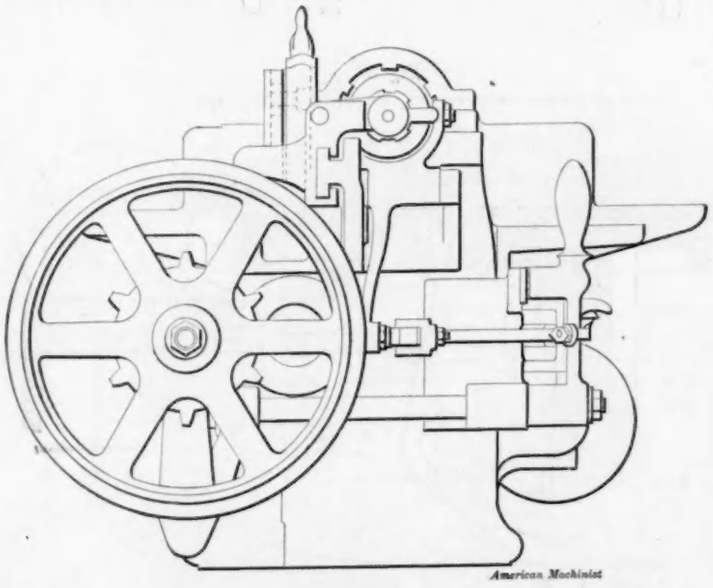


Fig. 10

END ELEVATION, SHOWING CHUCK OPERATING MECHANISM.

Still another form has the cone pulley and a plain slide designed for one hollow mill, a box tool, or a drill. This is the simplest form of the machine and is designed for forming and cutting off automatically comparatively simple pieces, such as bicycle chain rivets, etc. It takes stock up to ¼ inch diameter, and feeds up to 2 inches by one movement, or up to 10 inches by successive movements.

At Fig. 11 is a view of the tap and die revolving arrangement for the turret.

Sometimes it pays best to keep the machine running at a speed too high for the threading dies or taps, and by the arrangement shown the die is revolved in the same direction as the work is turning, but at about half the speed, thus reducing the threading speed to a proper rate without changing the machine.

When a rod of stock is used up the machine automatically stops and rings a small bell to notify the operator, and it is found that they can be kept very steadily at work at high speed, one attendant being easily able to keep six or more machines in full operation.

Road Wagons and Motors.

BY HUGH DOLNAR.

I have received several letters from mechanics who propose to build road wagons for themselves, and these letters, together with the suggestions of William H. Harrison ("American Machinist," April 6), show me that there is a great lack of information as to the actual condition of the mechanically-driven road wagon, and that many persons are struggling with problems which have been solved by those who have gone before in the same path. I shall, therefore, present the readers of this journal with a concise statement of the actual standing of the motocycle motor at the present time, in the belief that it will relieve many studious minds from the profitless task of rethreshing old straw.

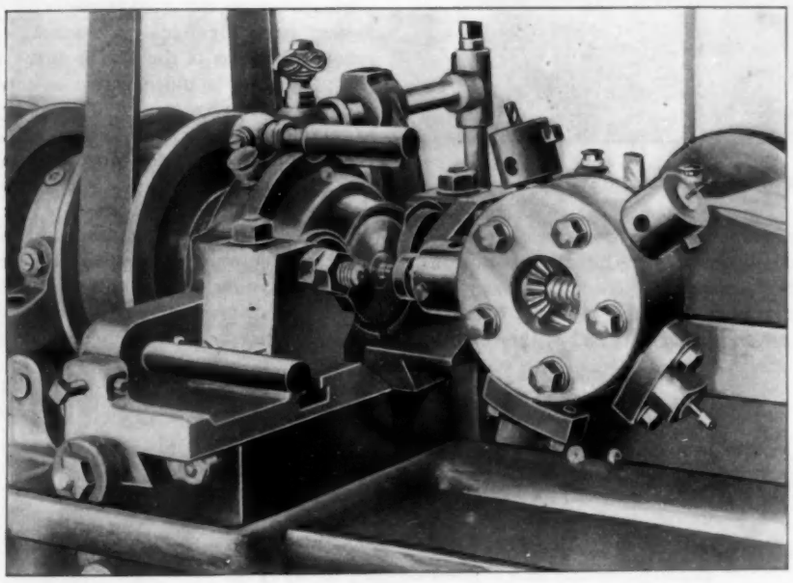


FIG. 11. THREADING AND TAPPING ATTACHMENT FOR AUTOMATIC SCREW MACHINE.

There are exactly two prime motors in sight, and no more, which are available for driving wagons on common roads. One of these is the steam engine, and the other is the explosion or gas engine. Electricity is not a prime motor, as it must itself be "generated" by some prime mover before it can be used for any purpose.

To dispose of the electrically-driven road wagon it only need be said that electric carriage motors can be bought of various makers; some of these motors are better than others. The weight of an electric motor suitable for driving a two-passenger carriage runs from 125 pounds up, according to the builder's ideas of the power required. To drive this motor any weight of storage batteries may be used, from 400 to 1,200 pounds being common practice. Any good mechanic can produce a fairly good electrically-driven wagon the first time trying. The cost is not very great, and there are no broad patents to hinder anyone from making mechanically-propelled wagons, driven by either electricity, steam, or explosion engines. The virtues of the electric carriage are many. It is clean, still, easily managed, and does not produce objectionable vapors. The electric carriage has also a good lot of large faults. It has to be a great deal too heavy for the paying load transported, and it can only run a little way without recharging. If more battery is added to give the wagon more range, the already too heavy wagon is made heavier, which is something very serious because of the wheel load imposed. Up to the present time nobody has found out how to make any really satisfactory passenger wagon wheel without a pneumatic tire, and nobody has found out how to make a really satisfactory pneumatic tire to carry a load of more than about 250 pounds. This means, of course, that the total loaded weight of a road wagon should not exceed 1,000 pounds at the outside. But there is not much satisfaction in a 1,000-pound electric carriage, because it has only a very limited range. On asphalt it may run eighteen or twenty miles if everything is in good form. Things are not always in good form in electric carriages, however. The motor, if by a good maker, is fairly reliable, and not subject to sudden and mysterious weaknesses. The storage batteries are another thing altogether. They can be spoiled by bad handling, and they deteriorate rapidly at best, and are, taken all around, by no means so reliable elements of mechanical traction as, say, a steam boiler or a gas engine. There is no limit to the speed at which a carriage may be driven by electricity; probably a mile a minute might be reached on a good asphalt road with an electric motor and pneumatic tires, but not much distance could be covered at that speed, because the batteries would soon become exhausted. As before mentioned, the great trouble is with the wheels. A set of four pneumatic tires which will stand up well under a 250-pound load on each can be had for $15, and at this price the owner of a road wagon could well afford new tires every year. But it is a common thing to place electric carriages on tires costing $200 per set, or $50 each, and even at that price the heavily-loaded tires are not sure of a long life.

Fig. 1 shows a section of one of Riker's $50 tires, 3 inches diameter, used under an individual wheel load of about 700 pounds. This hand sketch is carefully made from an actual section of the tire. The outer part is of comparatively hard rubber, to stand wear; the inner part, which has four turns of canvas about it, is much softer; these two parts are vulcanized into a single structure. The whole fabric must be of the very best materials which can be had, and the air pressure is 125 pounds to the inch. Steel wheel rims are commonly used, but, as is well known, wood rims are less likely to injure the tires, and Stanley's steam wagons have wooden wheel rims, which give excellent satisfaction on suburban roads.

All the advantages lie with small wheel

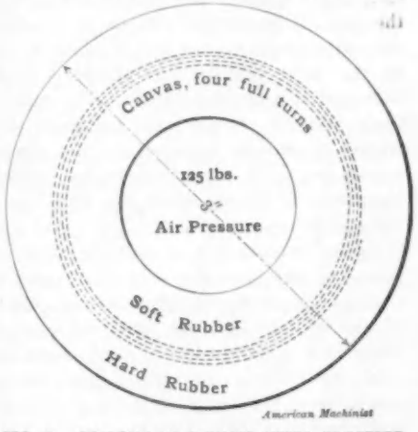


FIG. 1. SECTION OF 3-INCH RIKER ELECTRIC CARRIAGE TIRE.

diameters. The wheel diameters in motocycle practice run from 24 inches on some of the French machines to 36 and 42 inches, or even something more. For two or four passengers, probably 28 inches is the best diameter for pneumatic-tired

wheels. Stanley is just now sending out 100 wagons with wooden rim 28-inch wheels, which will tell by their behaviour in practice whether the wooden rim is suitable for light motocycle work or not.

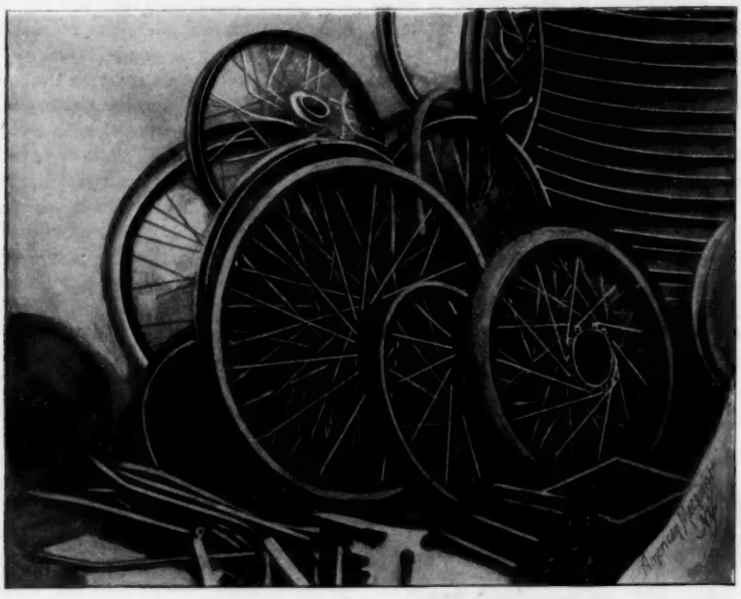


FIG. 2. WHAT HAPPENS TO WIRE SPOKE WHEELS IN CITIES.

The whole subject of wheels may be summarized as follows: There is no satisfactory wheel known for loads above 250 pounds per wheel; the smaller the wheel the stronger it is, and 28 inches is a common tire diameter. Wire spoke wheels, bicycle style, give good satisfaction in the country under light loads, but do not do so well for city use, as they are easily damaged by contact with the curb and with hubs of other vehicles. The first New York electric cabs had wire spoke wheels, and Fig. 2, from a photograph of '98, shows what happened them in city use. But for light loads and suburban use the 28-inch pneumatic tire on a wooden rim, with tangent wire spokes, appears to be the most reliable and strongest and best construction now known. The motocycle designer should fully recognize the weight limitations imposed by the pneumatic tire, and should, therefore, make lightness of every detail his first consideration.

Again, it costs just as much to drive a pound of wagon on the road as to carry a pound of passenger weight, and the object of the motocycle is to transport paying load; that is to say, other things than itself. An electric cab, such as are now in use in New York, weighs, with its driver, well towards 4,000 pounds, and carries two passengers only; if these passengers and their belongings weigh 400 pounds, then the paying load is about one-tenth of the total load, which is a highly uneconomical condition of affairs. The wagon should in all cases be as light as is possible, and it can be very light indeed. Hertel showed in 1895 a gas engine-driven wagon which weighed only 225 pounds. This was too small and light for practical use, but Hertel is now building two-passenger carriages, weighing less than 400 pounds empty, and the Stanley steam wagon, latest model, is said to weigh about 375 pounds empty. Whitney, of Boston, a tireless experimenter with steam wagons, believes that a vehicle weight of 1,000 or 1,200 pounds best fills all of the conditions. He says a heavy wagon "stays on the road" better than a light one. There seems to be no reason for giving a wagon more weight than strength demands, especially when it is fully realized that every added pound of wagon weight is an added load on the wheel tires, and also causes an increase of wheel stresses in various directions when turning corners. It is very clear to my mind that a mechanically-driven wagon should be as light as possible, say not to exceed 400 pounds for a two-passenger wagon with a motor capable of exerting about 8 horse-power for a short time at least, as is demanded in going up hills, and over muddy roads. It is possible to produce an explosion motor to give 8 horse-power inside of 100 pounds weight. The Stanley steam wagon boiler and engines weigh about 125 pounds, and can work fully up to 8 horse-power for a short time.

There is one point of the greatest importance which the student motocycle designer generally finds it convenient to ignore, and that is the spring support of the motor. It is much easier to connect the motor rigidly to the driving wheel support than to interpose springs to carry the weight of the motor, and the temptation to carry the motor directly on the driving wheel axle, or at most to give the motor only a very limited spring movement on the axle support, is very great. This proceeding places the weight of the motor and driving parts as a dead load on the wheel tires, and a pneumatic tire does

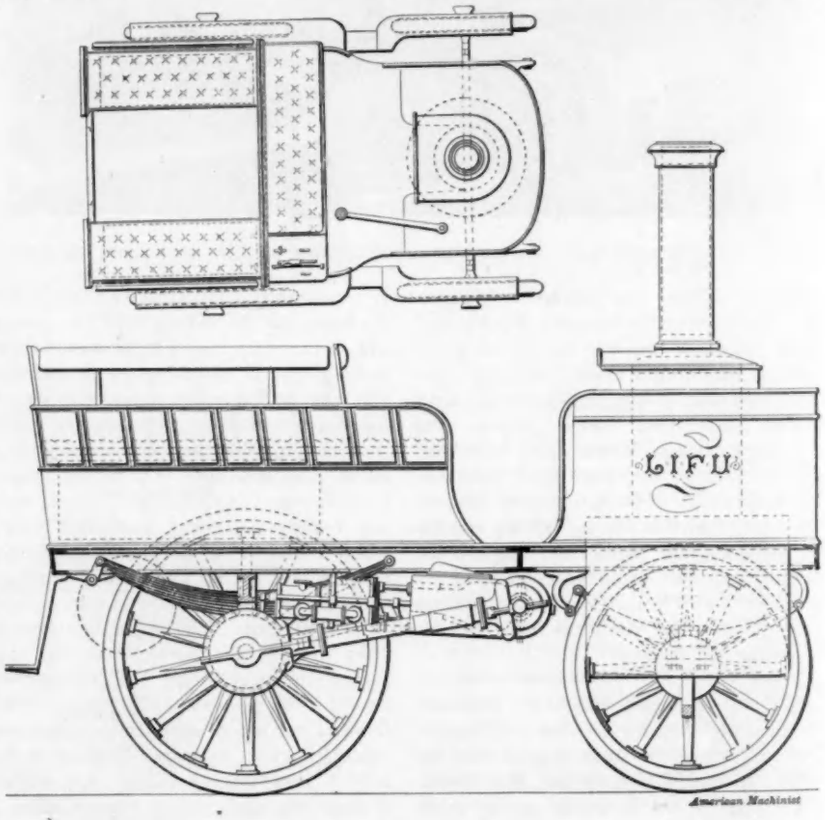


Fig. 3

BARON BARRETO'S HIGH-SPEED "LIFU" WAGONETTE.

not endure dead loads with much fortitude. It might seem, since the tire has to carry all the load finally, that it makes little difference how that load is supported on the wheel axles. This view is erroneous to the last degree. All load carried on either pneumatic or solid rubber tires should be spring supported, and the more flexible and yielding this spring support is made, the longer will be the life of both tires and axle bearings. The prime considerations in motocycle designing, as shown by practice up to the present time, are, first, reduce load as much as possible, and, second, carry every ounce possible of the load on good springs.

In regard to the tricycle form of vehicle, it should be noted that it has no real advantages and has a great many faults. It has so far been generally the work of inexperienced designers, and quickly abandoned, and it may be accepted as certain that the tricycle is in every way inferior to the four-wheeled wagon.

Compressed air and liquid carbonic acid gas are thought by some persons to be probably among the valuable road wagon motors. As to compressed air, if anyone happens to have a good compressed air-driven truck stored away in the back pattern room, or in his wood shed, he had better communicate with me. I can find him a purchaser for a million dollars cash, right here in New York. There are things about the liquid gas mentioned, which place it even farther out of the list of available road wagon motors than compressed air. Steam and the gas engine are the only things known to the world generally, except electricity for certain cases, which are at all suitable for wagon motors.

Because the gas engines does best when running at full power and speed, it has often been proposed to connect a dynamo to the gas engine shaft of a road wagon, and when running on a level or down hill to use the dynamo to charge a storage battery to help out in hard places, and a lot of quick thinkers are cherishing this plan as a happy thought. In the first place, it would double the weight of the wagon if storage battery enough to be of any use were installed. In the next place, a wagon can generally use all the power it has, as it does not take much increase of velocity to consume a great deal of power in the way of overcoming wind resistance. Emphatically, the simpler and lighter a road motor wagon can be made, the better.

There is, however, one combination of the gas engine and dynamo which gives excellent road wagon results. This is shown in Hertel's latest wagons, and consists of a dynamo weighing, I think, 10 or 11 pounds, driven by the gas engine motor and used to feed a storage battery weighing about 15 pounds only, which supplies the electric igniting spark for the motor, and also furnishes electricity for two large lamps. This seems to be a very meritorious combination, as both the lamps and the igniting spark are needed features, and an electric lamp gives the driver less trouble than any other, provided a good current supply is assured. Hertel's dynamo and storage battery add only something like 25 pounds weight, which can well be endured in view of the advantages gained.

Some English firms are sticking to steam-driven wagons with a fine old bulldog grip. One of these is the "Lifu," Cowes, Isle of Wight, and the illustration is given of a light "Lifu" road wagon in Fig. 4. Unfortunately, no particulars are available. It is really surprising how an ordinary press writer can use so much space talking about a machine without telling anything at all of what it is like.

This "Lifu" wagon is really a very tidy little locomotive, though from the look of its springs and its wheels it probably weighs not less than a ton empty, and one of those men who cannot be happy without overalls and a nose blacked with machine grease—there are such men—can get a lot of fun out of driving such a vehicle, as it will undoubtedly run day in and day out. The "Lifu" differs from Mr. Harrison's ideas, in having the boiler in front with a fine high smoke-stack. The boiler is made up of a great many little crooked water tubes, and is fired with heavy oil. The "Autocar," from which the "Lifu" illustration is taken, says that this wagon has actually made sixty miles an hour on the road. It is made to seat six passengers, as shown in the plan, and appears to have a bevel gear drive from the engine shaft to the driving wheels. This drive may be duplicated on the other side, so avoiding the compensating gear by the use of independent motors, or the compensating gear may be on the engine shaft. The "Lifu" works employ about 200 hands on yachts and motocycles, and are building a considerable number of heavy steam wagons, omnibuses, and so on. The "Lifu" motors are usually compound.

The preferences of the steam motor advocates seem to be about equally divided between water-tube boilers and plain cylinder boilers with vertical fire-tubes. The weight is about the same for a given power; some of the water-tube boilers are brazed up of copper, and some are made like the "Lifu," with a multitude of screwed joints. The gas engine has no boiler, and needs no water, but it does not reverse, and as generally made, it requires gasoline for fuel, which is highly dangerous. Well known and very successful forms of the internal combustion engine use kerosene oil for fuel, which is perfectly safe, and which can, it is asserted, be burned in an engine cylinder so perfectly as to avoid evil odors. The explosion engine can be made more cheaply and in less weights for the same power than a steam wagon motor, even when the needful change-gear is included in the weighing. All road wagons demand a backing movement, and should have at least three forward speeds; the proportions of 3, 6 and 12, the backing movement being 3, is a common driving scheme.

The great point in favor of the gas engine as opposed to steam for a wagon motor, is the fact that small cylindered gas engines run without using any water whatever, while the two-passenger steam motocycle must have 100 pounds of clean water for every 25 miles of travel. The steam engine is a better driver than the gas engine, as it will reverse, and can vary the power it exerts very largely. Otherwise, the points of advantage are, to my mind, all in favor of the explosion motor.

Machine Tools—VII.

BY JOHN RICHARDS.

MACHINE-TOOL FRAMES AND SUPPORTS.

It is a subject of much interest to study the evolution of machine-tool framing. At first, as in all other iron structures, there was close imitation of the wooden frames that preceded. The material was disposed in straight lines and at right angles, the corners molded, and in other respects in the same manner as in joiner work of wood. There was no conception of a homogeneous material that had equal strength in all directions, but only of wood, that had but little strength except in the direction of its fiber. In a band-sawing machine patented in England in 1808 by William Newbery, and of which there are good drawings, there has been dispute as to whether the frame was wood or iron. The records show, however, it was iron, framed up the same as if made of wood, joined together by mortises and tenons.

The architectural style of frames came also from the fact that patterns for castings were made in former times by joiners, who kept to their accustomed forms when frames were made of iron, merely reducing the sections because of the stronger material. The "ornate idea" came about in the same way. Panels, entablatures, fluted columns and the rest are now, let us hope, laid away in deference to a better taste, supplanted by true symmetry and proportions that harmonize with the strains and functions of the machines. The discovery—for so it may be called—that machine-tool frames should be plain, smooth and without ornamentation came about by natural selection. Hollow or box sections can fairly be ascribed to Whitworth, who once said his idea of such framing came from that of the human anatomy.

One of the main points in designing frames is to not expose thin sections, as in the case of holes through plates and webs. In a standard or column 12 inches on the sides, or in diameter, the exposed sections should not be less than 1½ inches; or, to make a rule, the exposed sections should be equal to an eighth of the extreme faces, as in Figs. 43 and 44. This is but a trifle of expense when making

a core-box, if there is no external bead to be matched, and these should not be employed, because they convey an idea of thin sections unless their width corresponds to the flange *e*, or to the base flanges of the frame.

Another feature that has a good deal to do with the symmetry of frames is the thickness of base flanges. These should follow the rule of exposed sections and equal an eighth of the faces or the diameter of the trunk above when the latter is and looks so. The only section other than that at *a* which presents a good appearance is an oval, a form which looks well only on parts having motion, as the spokes of wheels and pulleys, cranks, sectors and the like.

Struts or ties should be in straight lines, so also braces, unless set in curved intersections for reinforcement, as at *e*, in Fig. 50. If the corner at *a* is of short radius, as in pipe flanges, the brace *e* should be straight.

exceed one-half as thick as the members *e*.

The curved form for bracing ribs as at Fig. 52 is still adhered to in most cases by habit, and because we reluctantly abandon the old idea of curves and ornament, but we are fast reaching the point when the shape at Fig. 53 will be substituted for the curves.

Fig. 54 shows a cored section often seen in English machine-tool frames, but seldom in this country. It is especially suitable for large frames, and conveys an

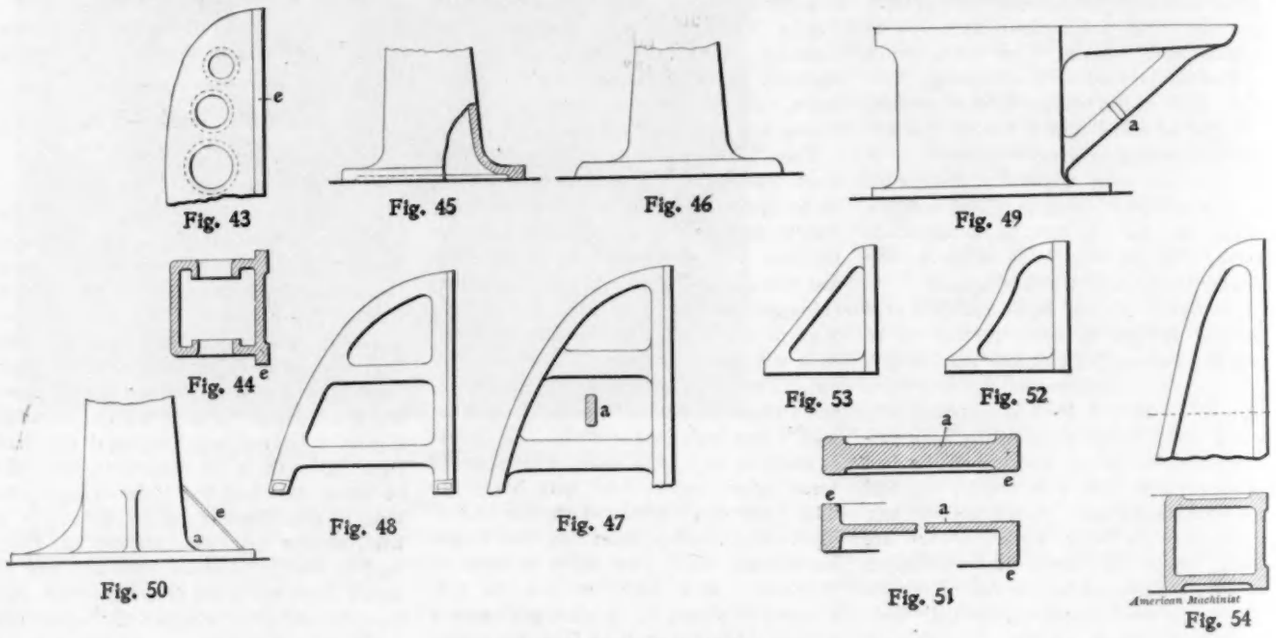


Fig. 43 Fig. 45 Fig. 46 Fig. 49

Fig. 44 Fig. 48 Fig. 47 Fig. 53 Fig. 52

Fig. 50 Fig. 51 Fig. 54

MACHINE TOOL FRAMING.

either round or rectangular. This is required not only to produce harmony of dimensions, but to insure against accident by fracture.

The base flanges for frames or pedestals larger than 10 inches in diameter should be cored out beneath, as shown in Fig. 45. This is a custom with English machine tool makers; also to some extent in this country, and has the advantage that in casting, the core print can be made large enough to permit access to the mold to trim up the faces, and the prints can be tapered so the flange is easy to draw, and can be made without draught on the top, which adds to its good appearance. The top corners of base flanges, when of the proportions named, should be slightly rounded, so as to avoid the contour indicated in Fig. 46, which is a monstrosity of the "ogee" order of architecture.

Struts are a difficult thing to bring into harmony with machine framing, especially when connecting to cylindrical or rectangular sections, as in Figs. 47, 48 and 49. When cored as in Fig. 48, which in some cases gives too heavy an appearance, the best way is to use a solid section as at *a* in Figs. 47 and 49, the corners being slightly rounded so as to harmonize with the other members, but never made semicircular. That is always wrong.

In rib sections, of which Fig. 51 shows examples, there is the common mistake, especially in English practice, of considering the web *a* as a principal member and the flange *e* a reinforcement. This leads to a thicker section for the plate, and is a waste of material. The web *a* is no more than a brace or tie, and should always be made as thin as it can be cast without cooling strains, usually not to

idea of an indented surface rather than of ribs, and is a means of relieving broad, flat surfaces that always look "skinny" unless perfectly flat and smooth. It also forms a reinforcement of corners which are the weakest part, and for any machine of fine character the corners can be finished.

LEGS OR SUPPORTS.

The legs of such machines as require

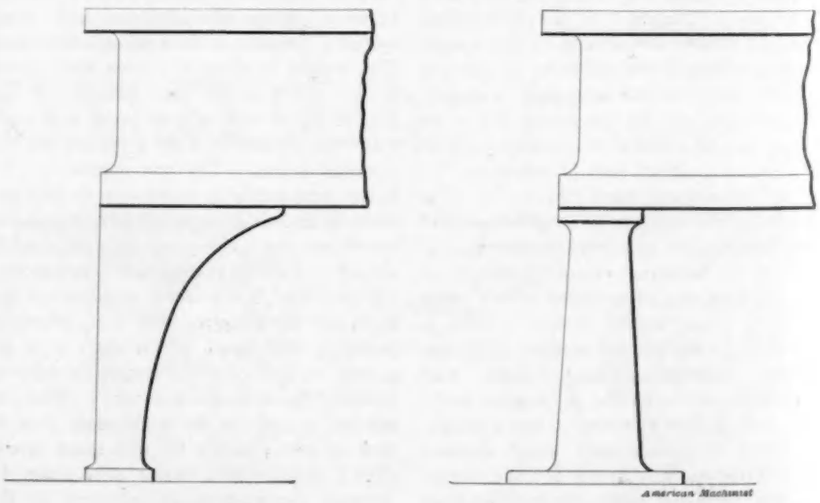


Fig. 55 Fig. 56

LEGS FOR MACHINE TOOLS.

to stand above a floor have a good deal to do with general appearance, and fortunately the sigmoidal curves and "lines of beauty" that once characterized such supports have disappeared from the designs of all the best makers. The hollow pedestal has to a great extent taken their place, looking well and serving a useful purpose as a locker.

There is a curious difference of design between machine supports in this country and abroad. The American type has its base on the frame and projects downward, as in Fig. 55, while the European type has its base on the foundation and projects upwards, as in Fig. 56, and seems a mere gravity support. The American one has this same function in its appearance, with the additional advantage of imparting some stability to the frame, and is certainly the more symmetrical of the two.

Gap lathes, also those made with frames that taper each way from the center always appear distorted because of not harmonizing with the other parts of the machine, such as the ways, lead-screw, motion rods, and so on, all of which are parallel or of uniform section. American makers have wisely avoided these things, and get along very well without them, including the gap lathes, which may be called an illogical attempt at combination, except in the case of a single lathe that has to be adapted to a variety of work, as in performing the repairs for a factory. This subject will be discussed in a future place.

Molding a Drop Press Bed.

BY R. H. PALMER.

Fig. 1 gives a side and front view of the casting to be made. Good coarse sand is needed for the mold.

First we make a bed of sand on the floor a little longer than the board, and say about 10 or 12 inches wide. We then place board *B*, Fig. 3, on this bed, and wedge up under the ends of the cleats *C*, leveling the board. The pattern is split in two pieces through the center *H*, Fig. 7, one arm being on each half of the pattern, the pattern being made so that the greater part is molded in the middle piece of the flask, or what we call the cheek, one half being drawn from either side. This cheek is made in two pieces, but, as Fig. 3 stands, it is really the middle part *F* to *G* of a three-part flask. We take the lower half *D*, Fig. 3, of the pattern and place it on the board, as shown in dotted lines, lower *A* forming the bottom line of the pattern as it rests on board. We then lower the cheek down over it. At *C*, Fig. 7, are seen flange irons bolted on the inside of cheek, and running from flange to flange, and resting on the flanges, are loose bars B. These bars are placed in position after facing sand, mixed five and a half parts coarse molding sand and one part coarse ground bituminous coal, is covered over the jaw of the pattern about 1 inch deep. These bars are to take the upward strain while pouring, and at the same time to carry gaggers and support the mass of sand in this part of the cheek. It is then gaggered and rammed up at this end above the lower half of the pattern, and given a good venting down to near the pattern. Then a pocket of cinders is placed over the vents, *A*, Fig. 7, and connections are formed between this pocket and holes in the side of the flask, *I*, Fig. 7, to allow the vent to freely escape. The top half of the pattern, *E*, Fig. 3, *J*, Fig. 7, is then put on the other half, and some pieces of pig iron are used as weights to keep it from slipping or rising while being tucked up. After the cheek is rammed and the parting made, as you stand looking down on it, you have Fig. 5. Dotted in at *B* is seen the core print for the name plate core. *A*, Fig. 5, is the main gate stick, set at the proper time, also *D*, Fig. 5, is the smaller gate

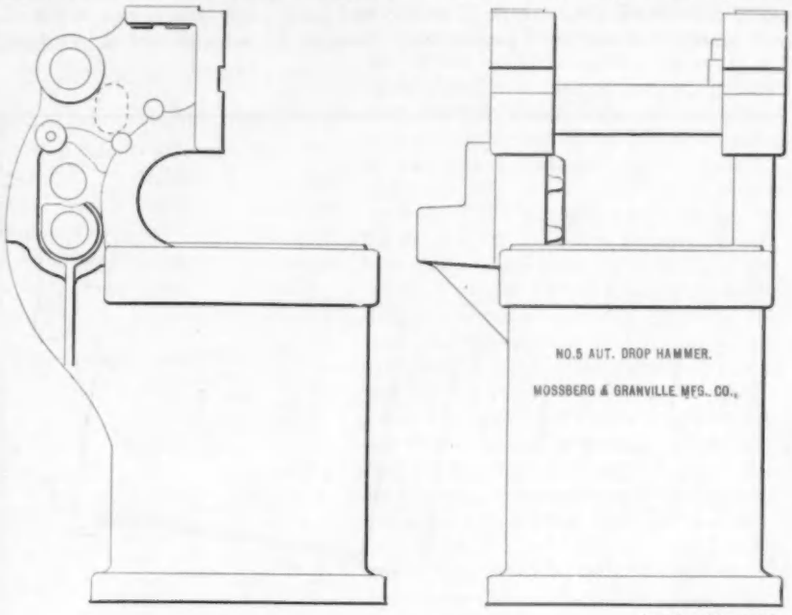


Fig. 1

THE CASTING TO BE MADE.

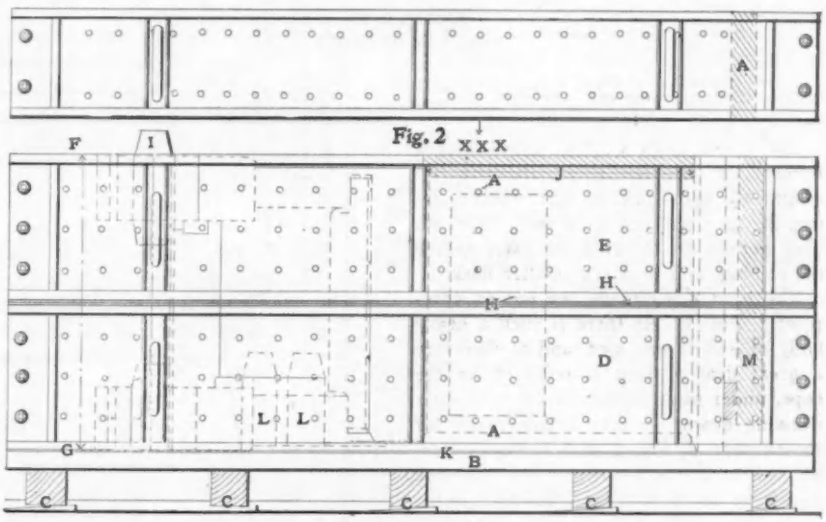


Fig. 2

Fig. 3

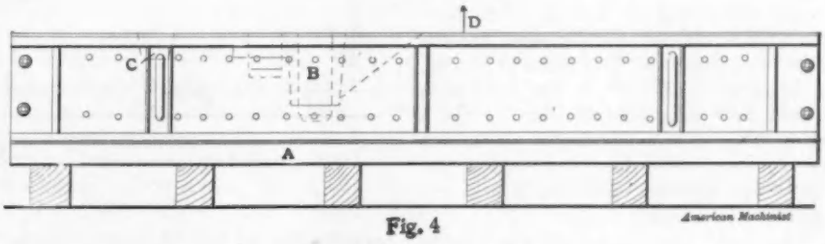


Fig. 4

THE MOLD SEPARATED.

stick. These castings are poured with very dull iron, and there is great danger of some parts of the jaw coming cold shut, so, when the large ladle is started, and as soon as enough iron has been put into the mold to cover the bottom, a ladle of sharp iron is poured into this small gate to liven up the iron running into the jaw, and in that way good results are obtained.

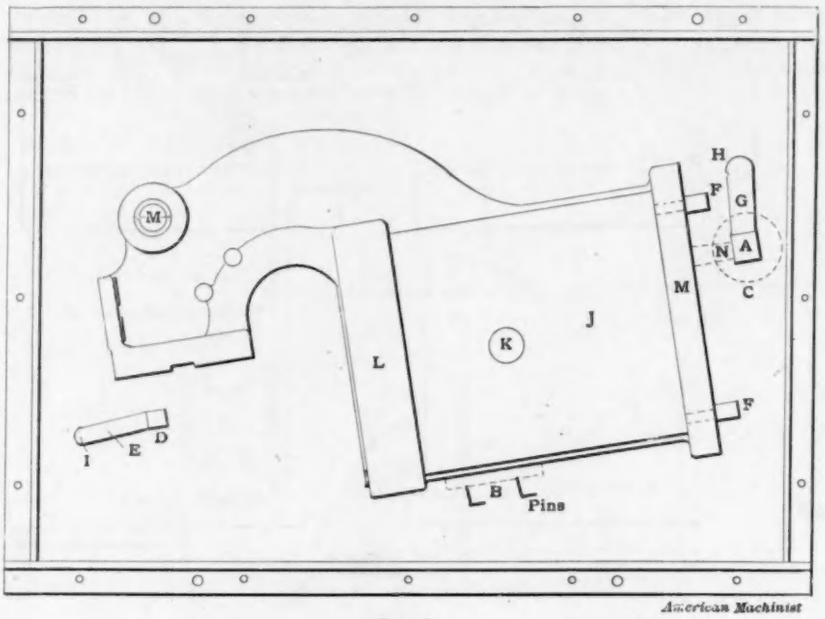


Fig. 5
DRAG SIDE OF CHEEK.

The dotted circle *C*, Fig. 5, indicates a number of cast-iron rings rammed up around the gate-stick, so that, when pouring, the gate will not burst into the mold. This permits us to bring the gates nearer the casting, and to use a smaller flask.

The joint being made, we put on core-print *I*, Fig. 3. As there is such a heavy body of iron in one spot, and as therefore a great deal of heat is reflected on the cope, under some circumstances causing a drawing down, we take a core made for the purpose, *J*, Fig. 3, also *J*, Fig. 5, having a hole in the center for the churning gate to be set in, *K*, Fig. 5, and fit it in between the bands of the casting, *L* and *M*, Fig. 5. We then lower the cope, Fig. 2, on, after wetting it. The wires or bolts for holding the core are arranged, and the cope is rammed up. The board at *B*, Fig. 3, is bolted on to joint *K*; the joint *H* is bolted, and joint between Figs. 3 and 2 also. Then a board is bolted on the top of the cope, after the wires holding the cores are fastened, and the cheek and cope are rolled over.

The board being removed, the joint at *D X*, Fig. 7, is made. You are then looking down on general outlines of Fig. 6. We put the core that we have fitted on to the drag side of the pattern *A*, Fig. 6, also loose pieces *B* and *C*, Fig. 4, also *B*, Fig. 6, on, and after arranging wires to lift and hold core A, Fig. 6, we bring the drag down to meet *K*, Fig. 3. We ram up the drag, secure the wires to hold the cores, and rub the board A, Fig. 4, to a bearing; take it off, and vent where needed; put it back, and bolt home. We hoist off the drag, roll it over, and finish and black. Now take a look at Fig. 6, and imagine the core marked *A, A, A, A* has been hoisted up with the drag, leaving it looking as it would without lines *X, X*. We hitch on to this half of the pattern, and, having drawn it out, finish the jaw and black it, also cut the gate *C*, Fig. 6. We then set the core in the print *D*, Fig. 6, or *F*, Fig. 7. The dotted line at *D*, Fig. 6, shows the core passing through the casting, and at *K*, Fig. 7, are prints of two cores *K, K*, which pass through this core. See these cores also at *E*, Fig. 6. These cores are then set, also cores *F*, Fig. 6, then *L, L*, Fig. 3, these being the same as *K, K*, Fig. 7.

We try the drag on, and, seeing that it bears right, close it on for good. And now the whole flask of three parts bolted together must be rolled over. When it is rolled over this time we try to leave it where we want to pour it; and as one-half of the pattern is out, and we cannot get at the jaw of the lower half if anything gives way, we must handle with care, remembering that a sudden jar might spoil all our work. So we place a pile of sand against the side of the flask toward which we are to roll it, so that in going over it cushions on this mound of sand. Having it rolled over, we take off the board and hoist cope. We then have Fig. 5, with core *J* hoisted in the cope. Roll over the cope, and finish it. We then draw the cope half of the pattern from the cheek; and before finishing the cheek we take a fine vent wire and carefully vent down through the sand to the cinder bed *A*, Fig. 7, and when ramming up the cheek, if there is room, we run two cinder beds between the jaws—one near the upper side, and one near the lower. It is one of the most important points that the vent escape freely from the surface of this mold; as, if it does not, the iron will begin working on the face of the mold and the casting will be scabbed. Again, we put the core in the bottom, not only for the iron to strike on when pouring, but as both cope and drag have bars in them, the mass of iron straining on the drag would otherwise show every bar; and as it is difficult to get the surface just so hard all over, I think the core the best way. In the core

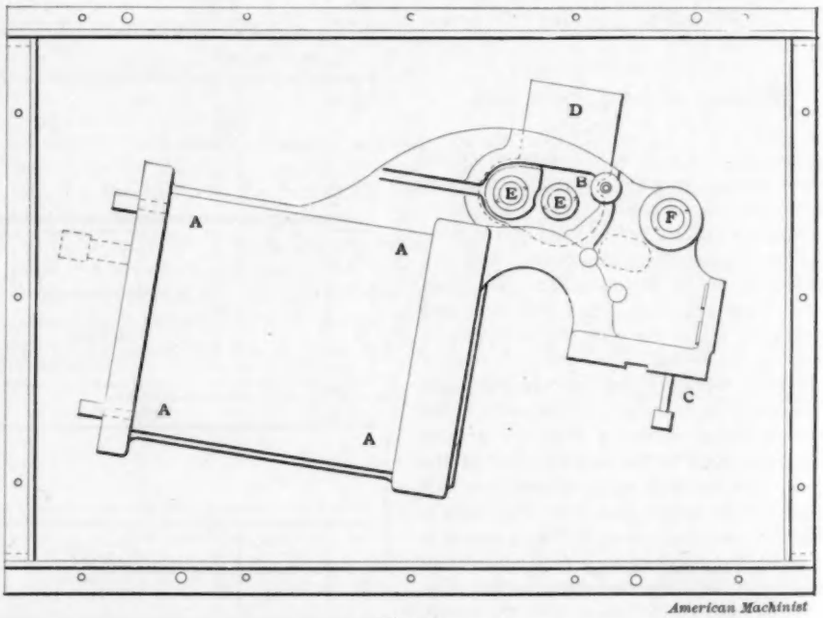


Fig. 6
COPE SIDE OF CHEEK.

used on cope half *J*, Fig. 5, you see at *K* a round hole where the gate for churning is set. Having finished and blackened the mold, we try the cope on, and finding that it bears as we wish, close it on for good, but making up runners and riser-heads first. At *G*, Fig. 5, is shown where a gate is cut in the cheek to connect gate *H* in cope with gate *A* in cheek; also, in Fig. 5, where gate *E* connects gate *I* in cope with gate *D* in cheek. *F*, Fig. 5, are core-prints in the bottom band of the anvil, there being two on each side. Core-print *B* is drawn in the mold after the two halves have been drawn out. Pins holding this print were taken out at the proper time

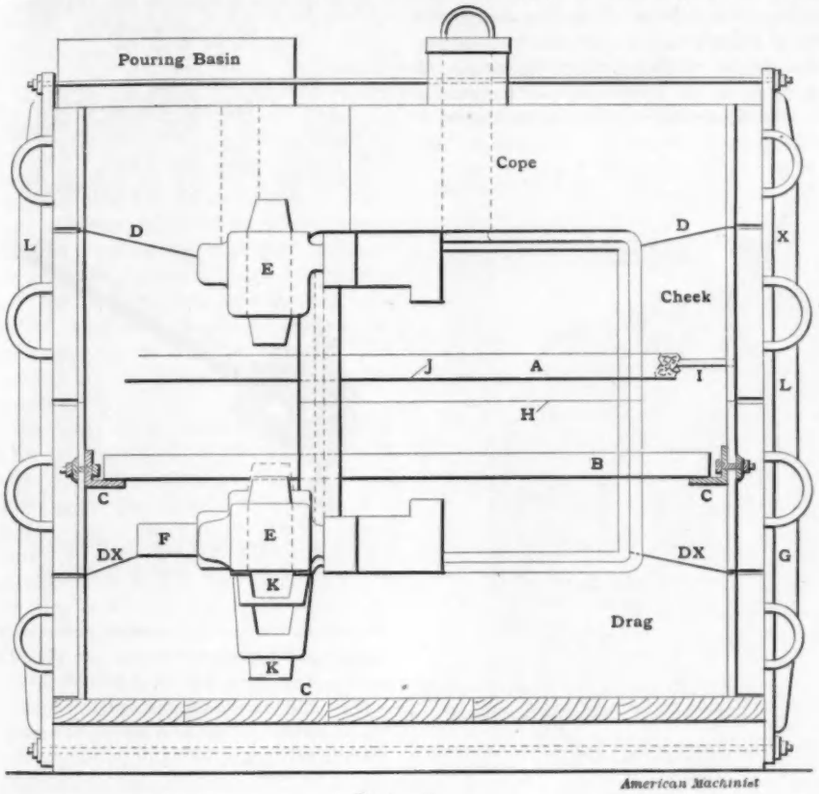


Fig. 7

FLASK COMPLETE.

while ramming up the cheek. This name-plate core is set in the mold, and when the casting is cleaned the lettering comes out in bold relief. *L*, Fig. 7, shows side binders where the heaviest side-strain comes.

Do not uncover a casting of this kind too quickly, if it is a chunk. Remember in pouring to get the iron in as quickly as you can. The runner shown will take the iron very fast. I referred to the cheek being in two parts; by having it this way I could unbolt it at *H*, Fig. 3, and I then had two flasks to make the uprights in for the same machine, also for other work. In fact, by having these different parts of flasks of iron with about a 10-inch cope and 12-inch drag, and the bolt holes matching, I could pile a number one on top of another and use them on a great variety of work. All parts of the mold are faced, except where the cores are used.

A New Smoke Consumer.

Frank H. Mason, Consul General at Berlin, sends an interesting account of the system of Paul Cornelius for the more perfect combustion of bituminous coal, slack, sawdust and other inferior fuels. The following is Mr. Mason's description, written after having visited an installation in Berlin:

"The two boilers are of the ordinary flue pattern, placed side by side, and their furnaces separated by a dividing wall, so that one can be thrown out of use or turned on, as occasion may require. The furnaces are about 10 by 4 feet in area, and the smoke passes by subterranean flues to a stack chimney standing in a central court and rising above the roof of the building. Near the furnaces is located an ordinary fan blower, driven by an electrical motor of one-half horse-power, the speed of which is easily controlled, and which drives the air through a 6-inch pipe into a hollow iron chamber about 10 inches deep, which forms the front section of the hearth of the furnaces. Into this air chamber is fitted one end of the hollow grate bars, which are about 2½ inches in diameter, extend backward the length of the furnace, and are supported by ordinary bearings at the further end. These hollow grate bars are round on the bottom, but at the top are hexagonal, presenting three faces, each pierced with holes about 2 inches apart and beginning with a calibre of ⅛ inch, which increases slightly throughout the length of the bar, to equalize the discharge of air from the gradually decreasing pressure within.

"The hollow grate bars are laid about 6 inches apart, and there are placed between each pair three solid triangular bars, which assist in sustaining the weight of the burning fuel. The air being forced by the fan blower into the hollow chamber, is there heated from the fire on its upper surface, then passes into the hollow grate bars, and is injected upward in three rows of jets, one vertical and two inclined to right and left, so that the entire under surface of the burning mass resting on the grate is fed constantly by jets of fresh-heated air, which generate from the most ordinary grades of fuel an intense white heat, which can be perfectly controlled by regulating the speed of the fan blower, and produce a combustion so natural and perfect that the smoke is entirely consumed.

"At the time of my visit the fuel in use was what is known as 'coaksgries,' or coke dust, the fine slack that comes from screening gas coke, the scrapings of retorts, etc., which has hitherto been regarded as worthless, except for ballasting roads and footpaths. The bed of burning fuel was maintained over the surface of the grate about 5 inches deep, and the fire was white, intense, and evenly distributed. The air current being stopped, the fire at once dropped to a reddish tinge and began to smoke.

"With an apparatus so simple and natural in principle as this, some surprising results have been already obtained, altnough the practical application of the process is in its infancy. The proprietor of the hotel, who has had the apparatus in use since December, gives it the highest approval, stating deliberately in his certificate that it has reduced by three-fourths his outlay of fuel, worked with efficiency at all times, and completely eliminated the smoke and soot which formerly, when the best Silesian lump coal was used, blackened the walls and floor of the hotel court, and formed a nuisance of which his guests frequently complained. It was, in fact, for the purpose of abating the smoke and soot plague, rather than of saving expense of fuel, that the system was adopted for trial. The coke dust used as fuel contains a high percentage of inorganic matter, and the yield of ashes is thereby necessarily increased, but, all elements duly considered —cost of fuel, labor of removing ashes, etc.—the fuel cost of running the engine, month by month, as compared with the previous year, has been less than one-fourth of the fuel cost for the same boiler, engine and electric current, generated with Silesian lump coal.

. . . . . .

"It will be understood that while any fuel—lump or nut coal, for instance—burns fiercely on a Cornelius grate, perfect combustion with consumption of smoke gases requires the fuel to be pulverized, so that for naval purposes lump coal would have to be crushed in order to secure the best results."

A Universal Ratchet Drill.

The ratchet drill has always been and is still more or less a makeshift or an emergency tool for the machinist and others. It has, however, helped him over many a hard place and out of many a bad scrape, and enabled him to do many things which would have been otherwise impossible, and in most establishments, especially for repairing, or for occasional and unusual work, the ratchet drill has still a field of usefulness which it is likely to continue to occupy. It may have been thought that the ratchet drill was completely invented long years ago. That it was not complete, or nearly so, is evidenced by the combination of improvements embodied in the drill which we now have the pleasure of laying before our readers.

A ratchet drill, is, of course, designed for rotating a drill (or sometimes a tap or a reamer) by hand in a place where the rotative movement of the lever cannot be continued all around the axial line. This simple condition it has fulfilled quite satisfactorily; but those who have used it have often encountered additional conditions which have made the case much more difficult, and have, indeed, often defeated the ratchet drill completely. In many cases, on account of obstructions, it has been impossible to have the handle in its normal plane, while if it could have been bent at some angle, either towards the drill or still farther away from it, the obstacle would have been cleared. In other cases the situation has been such that the lever could have no rotative movement at all, but could only be moved in planes parallel to the axis of the drill. These conditions would of course defeat the common ratchet drill, but have no deterrent effect with the present ingenious device.

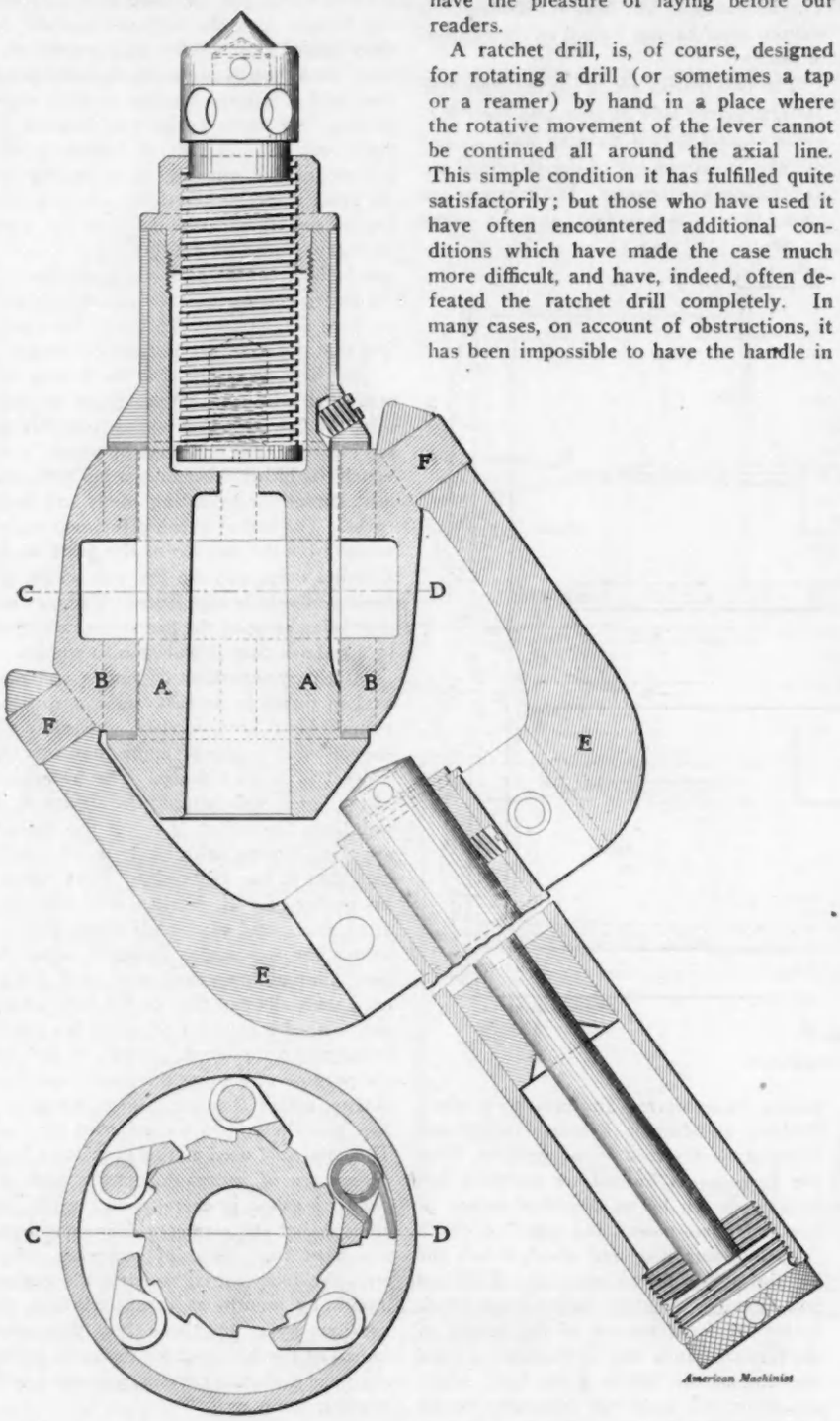


Fig. 1

VERTICAL AND CROSS SECTIONS OF UNIVERSAL RATCHET DRILL.

The construction of the drill will be understood by reference to Fig. 1, which is a central vertical section of the drill complete, with a cross section showing the ratchet teeth and pawls. The drill consists of the usual central spindle *A*, with socket for the regular taper shank drills and a screw for feed on the other end. The feed nut is screwed into the upper end of the spindle with a fine left-hand thread. The feed screw has a right-hand square thread. The inner end of this screw is tapped with a fine left-hand thread, and in this is a screw with a head rather larger in diameter than the outside diameter of the feed screw, this head serving as a stop to prevent the feed screw from coming out of the nut, or from ever being subjected to pressure without a full bearing through the nut, thus effectually

FIG. 2. LEVER SECURED FOR ORDINARY RATCHET WORK.

FIG. 3. LEVER SECURED AT AN ANGLE TO CLEAR AN OBSTRUCTION.

FIG. 4. BEGINNING OF ANGULAR MOVEMENT OF LEVER.

preventing the demoralization of the threads in the feed screw and nut. A pin for operating the feed screw is screwed into the outer end of the operating lever of the drill. The spindle,

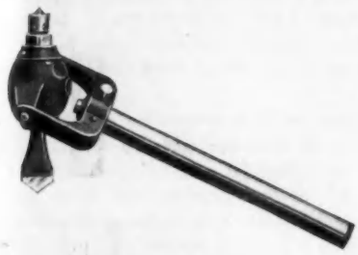


FIG. 5. CONCLUSION OF ANGULAR MOVEMENT OF LEVER.

as shown in the cross section, has twelve regularly spaced ratchet teeth, while the sleeve carries five pawls, also equally spaced, so that but one pawl engages at a time, and only 1-60 of a rotation, or 6 degrees of backward movement of the sleeve, is required before the next pawl engages, this arrangement saving much lost motion over the single pawl arrangement, the greatest possible movement without the re-engagement of a pawl being in this case less than 2 inches at the end of the 16-inch lever.

The really novel feature of this drill is in the attachment of the operating lever *E* to the sleeve. Instead of being attached rigidly to the sleeve, as is customary, it is made to freely swing upon the two trunnions *F F*, which are of solid metal with the sleeve. The two halves *E E* of the operating lever jaw are made alike, one half lapping over and the other half under at the center, to enable them to be slipped over the trunnions *F F* before they are fastened together by the two cap-screws.

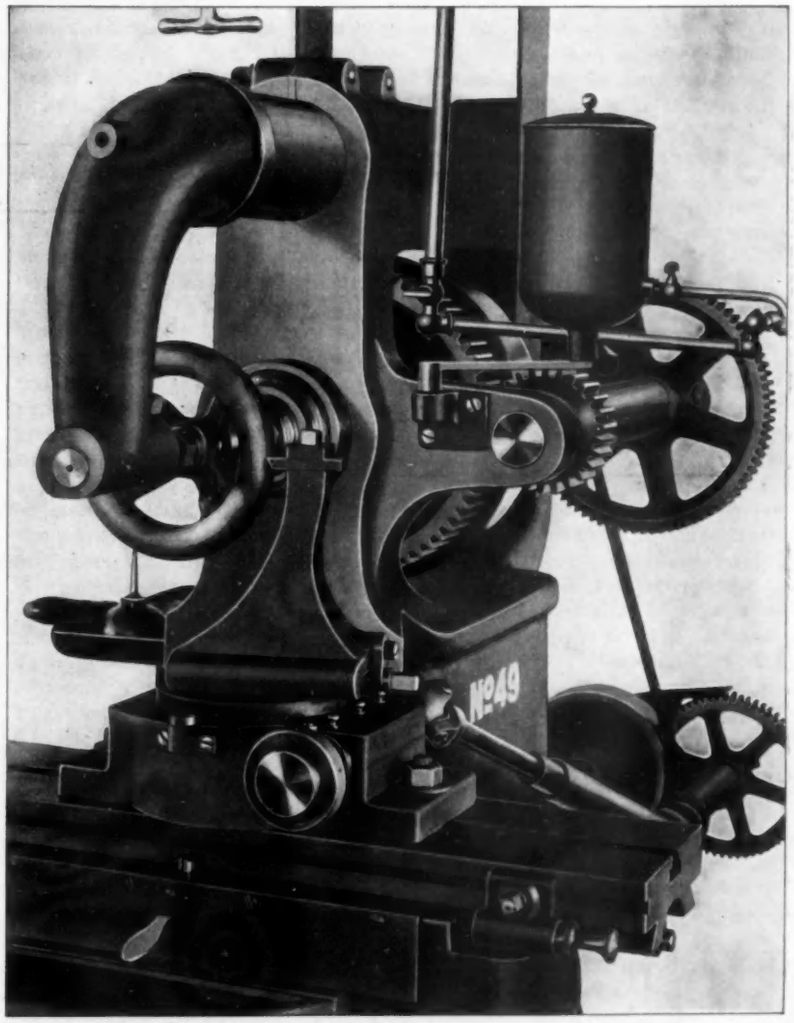
Supposing the drill to be vertical, the lever may be swung to the horizontal position and then moved back and forth in the horizontal plane, and the movement will be precisely the same as with the ordinary ratchet drill. If it fatigues the operator, as it will, to constantly hold the weight of the lever, the screw *H* may be adjusted so that its conical head will set into a large counter-sink in the side of the sleeve, as in Fig. 2, and the lever will then be rigidly secured to the sleeve and held in the horizontal position. If there should be some obstruction interfering with the movement, and which would be cleared by elevating the handle, it may be rigidly fastened to the sleeve in the position shown in Fig. 3 by screwing *H* into another large counter-sink which is provided; and the handle may also be secured in a similar position below the center by means of a third counter-sink on the outside of sleeve *B*.

Slacking the screw *H*, and leaving the lever free to swing on the sleeve, the drill may also be operated by moving the lever in any angular direction, as from the position of Fig. 4, where the lever is above the center and inclined backward from the observer, to the position of Fig. 5, where the lever has been brought to a position below the center, and also with a considerable inclination toward the observer. The movement may be at any angle from the horizontal to the vertical, and including both, and it must in any case cause a rotation of the sleeve and of the drill which it carries. If the required angular movement of the lever was in the plane at right angles to the line of trunnions *F F*, it would of course then produce no rotation, but in that case, the drill being out of the socket, the lever may be swung to the other side of the sleeve, reversing the relative position of the trunnions, when the movement of the handle in the required direction becomes effective.

It is not claimed for this drill that it can be operated with equal comfort with the handle moved in any direction, but the ability to move with effect in any direction evidently enables the drill to do what the old-style drill could not do, and to work in places where the old drill could not be thought of. The drill is made of steel throughout, and has been thoroughly tested for as heavy work as is done by any ratchet drill of its size. It is made with either a standard taper hole or a square hole, and a changeable taper socket with a square hole is also provided, so that either style of drill may be used. The drill, which is called the Williams Universal Ratchet, is the joint invention of Harvey D. Williams, formerly Assistant Professor of Machine Design at Cornell University; Horace G. Hoadley, of Waterbury, Conn., and Everett C. Lewis, of Woonsocket, R. I., and is made by the Waterbury Tool Company, Waterbury Conn.

Hand-Wheel Rim Turning Attachment for Milling Machine.

We give herewith an engraving of an attachment for turning round rims of hand-wheels by the use of a milling machine. The device consists of a base fitted to the milling machine platen, and within this base is fitted a turn-table with worm teeth on its periphery, by which it is rotated, the motion for this being taken



ATTACHMENT TO MILLING MACHINE FOR TURNING RIMS OF HAND-WHEELS.

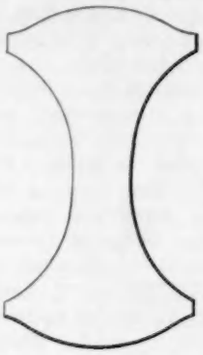


Fig. 1

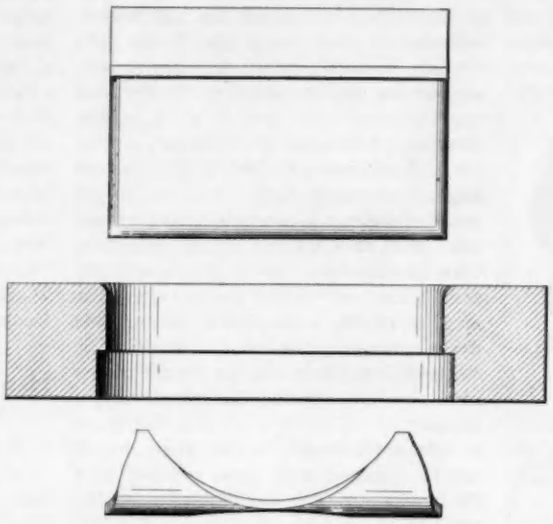


Fig. 2

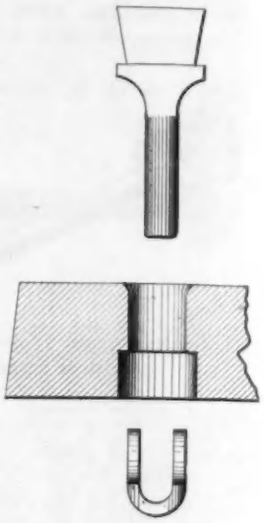


Fig. 3

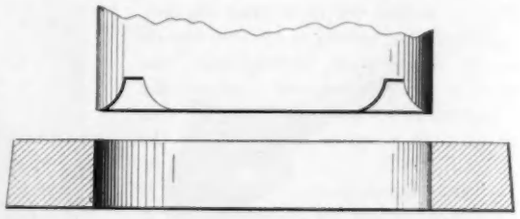


Fig. 5

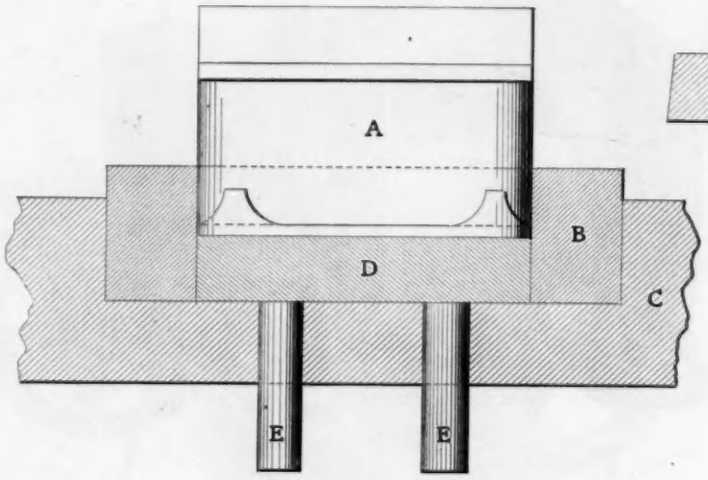
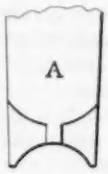


Fig. 4



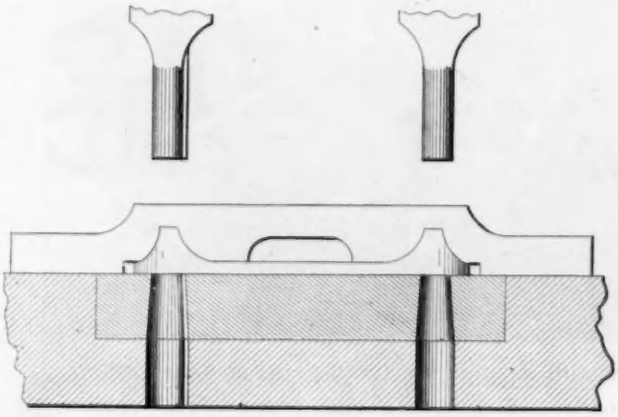


Fig. 6

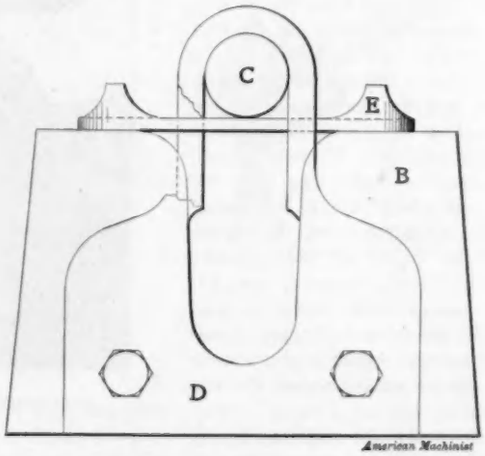


Fig. 7

TOOLS FOR MAKING A COLD-DRAWN CLAMP.

from the regular feed shaft of the milling machine.

On top of the turn-table is a cross slide, by which the tools are adjusted to the cut and, there is a disengaging device by which the feed is released at any desired point. Two tools are used, these being set at any required distance from each other, according to the diameter of the rim.

Rotative movement may be imparted by means of the knurled disk when setting the cutters. This attachment has capacity to turn hand-wheels up to 18 inches diameter with 2-inch rims, and in the shops of its maker turns a 7-inch wheel with 1½-inch rim ready for polishing in twenty minutes. It is made by the Diamond Machine Company, Providence, R. I.

A Cold-Drawn Clamp.

BY W. A. WARMAN.

The stamping shown is one not exactly calculated to smoothe any of the ruffles out of a diemaker's temper, if he has any, —and some have. It is plain sailing with a little patience and a stiff press.

Fig. 1 is the blank; Figs. 2 and 3 show

A COLD-DRAWN CLAMP, FULL SIZE.

the first forming operation. In this operation the blank is simply pushed through and allowed to shape itself as shown under the die, Figs. 2 and 3. Four gage pins (not shown) are required to locate the blank on the die. Fig. 4 shows section of upsetting die and punch, with work in place. This consists of punch *A*, the die B, bed-plate *C*, push-out *D* and the pins *E E;* the push-out to be operated by the ram with rods, springs of reasonable size being scarcely equal to the task. By freeing the die for about 3-16 inch at the top, and not allowing the push-out to rise farther than sufficient to free the work, no gage is necessary.

Do not try this operation on a press lighter than a "Stiles" No. 5, or you may have a job for the repair shop.

Fig. 5 is a die for shaving the ends of the stamping. Fig. 6 punches the holes. Fig. 7 shows piece ready for final operation. This die has the punch *A*, die *B*, mandrel *C*, and two guides *D*, one on each side of the die to guide the mandrel *C;* gages to locate *E* not shown. The construction and operation of this die, I think, are sufficiently clear in the sketch to make further detail unnecessary. The construction of these tools requires some care and everything must be rigid and strong, but the product is sufficiently pleasing to warrant the time and trouble. The clamp made in this way is so far superior to a forging as to make comparisons impossible.

Letters from Practical Men

The Machinist and the Molder.

Editor American Machinist:

I believe I have been learning something about the way to read the "American Machinist." I suppose I have been like a good many other readers, and have generally assumed that only that part of the paper that bore upon my own trade or special line of occupation was for me to read, and that I could skip the rest without losing anything. Being a machinist of the machinists I of course always read everything that comes along about machine shop work and ways, but what have I got to do, for instance, with foundry articles? It is very certain now that I will never be a molder, and therefore all that tells about ramming sand and venting cores and melting and pouring metal is so much waste paper to me.

That is the way I have been feeling all along. The machine shop has been the one fact, and almost the sole factor, of all machine production, and it has had in my mind all the glory for all that has been done. When any fine machine is turned out, or any successful machine if not so fine, a Corliss engine, a printing press, a power loom, a locomotive or a steamship, what is either of them but a product of the machine shop? The iron or steel or brass castings, the forgings, the piping, the boiler work, and all the rest, come to the machinist simply as raw material, the machinist then does the work and deserves the credit. That's the way I have been thinking, and it's beginning to dawn upon me that I have been considerably wrong, and on account of it I have missed learning several things that I might have known and that would have done me good and have been of use to me; and if I now give myself a little talking to, it may not be bad for some of the other young fellows who are disposed to make the same mistake that I have been making.

Just the reverse of my habit about reading and learning I suppose would have been more correct. Whatever information may be contained in any article is intended first of all for, and should be of the most value to, the one who does not know it all. It is not always that the machine shop matter contains anything new to me, or really helps me, but I can seldom read a good molder's article without not only learning something that I did not know, but receiving also additional reason for respecting the molder more. If the trades can be introduced to each other and learn to know more of each other's trials and needs in working, and especially if the molder and the machinist can know each other better, it will tend to their mutually better understanding and appreciation.

The machinist and the molder are constantly associated, and you might say that they work side by side, and they certainly ought to know and respect each other better. I suppose that the great reason that they don't is because their work is so different. It is so different that the one is almost an absolute contrast to that of the other. The work of the lawyer or of the doctor, or of the clergyman, does not differ from that of either of the others nearly as much as does the work of the molder from that of the machinist. The mental attitude of the one toward his work is as different as possible from that of the other. One deals with certainties and the other with uncertainties. The machinist uses precise measures and movements and secures absolutely certain results; he knows just what he will have when his work is done. In turning a piece in the lathe he rotates it at a certain speed, he gives a certain feed to the tool, with a certain depth of cut, and there is absolutely no chance to question what will be accomplished. He can stand in perfect confidence and see the operation go on. Nearly all of his work has the same atmosphere of certainty about it. He is told, or he knows in each individual case, precisely what to do and how to do it, and what he is to have when done, and things come out invariably as planned.

The molder necessarily employs means and methods neither of which, according to the machinists' standards, are accurate or to be relied on, and the results are always in question until the last operation is completed. The daily pouring off is more or less of a lottery, after all, with a tolerable certainty of more or less blanks in the drawing. The occupations, all through, of the machinist and the molder are, I suppose, as different as are those of the banker and the stock broker.

Perhaps there is no better lesson near at hand as to the difference in the ways and methods of the machinist and the molder than is to be found on the one side in recent articles in the "American Machinist" upon die construction by Mr. Painter and others, and on the other side in the foundry articles by Mr. Palmer. That "Molding a Wheel Segment," in the issue of April 27, just gives an idea of the unprecision in every detail of the operations, of the multiplicity of such details, each involving an act of judgment apparently closely allied to guesswork, and yet after all of the astonishing reliability of result. A built-up, true-running fly-wheel is one of the jobs which, when finished, the machinist is habitually

proud of, and just as habitually regards as his triumph exclusively; but, after this, when I see one of those wheels I will be ready to take off my hat to the fellow that made the castings.

TECUMSEH SWIFT.

Larger Locomotives Built at Horwich.

Editor American Machinist:

Some time ago you published a very entertaining and appreciative account of the Horwich shops, England. In view of the heavy shipments of American locomotives to England, just now reported in the daily press, the clipping I send, from the Accrington (Lancashire) "Observer and Times," may be of interest. I take it from the issue of April 29, 1899.

R. I. CLEGG.

The item referred to by Mr. Clegg reads as follows:

NEW TYPE OF RAILWAY ENGINE.

"The Lancashire & Yorkshire Railway have placed on their Liverpool & Southport line a new type of engine—one of twenty which are being constructed at their Horwich works to furnish greater traction power, with, it is hoped, an economy in the relative cost of fuel. The engine is noticeable for the greater elevation of the boiler, with larger firebox and longer body. Its weight is 90 tons, which is ten tons in excess of the older type of engine; the diameter of the driving wheels is 7 feet 3 inches."

Grinding Work Without Dogging.

Editor American Machinist:

I was much interested in the article on grinding and attachments for holding work, designed by Mr. A. B. Landis, in your issue of May 18, and I have a way which may not be new to all readers of the "American Machinist," but I have not seen it in any of the articles on grinding published. In grinding soft steel shafts to be finished one diameter over all, use the ordinary live center in the headstock ground so as to have three points of bearing in the center of the shaft. By tapping the shaft lightly against the live center, it will drive it with a heavy cut. This produces a shaft more true than one ground in the ordinary way of placing a dog on one end and grinding half of the shaft, then reversing and finishing the other end.

GRINDER.

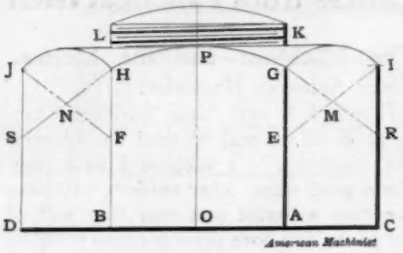
[We think the more generally approved practice is to drill one or sometimes two small holes in the end of the shaft and put a driver on the center adapted to engage these holes. By using a template they can be easily drilled at a uniform distance from the center, and by this plan the dead center can be used if desired, because the driver can be fastened to the whirl-plate, and it is better not to subject the spindle of the grinder (which must be depended upon for true internal grinding) to wear when work can as well be ground on dead centers.—Ed.]

Drawing Hexagon Nuts.

Editor American Machinist:

I send sketch showing another method of drawing a hexagon nut, which may interest some of your readers.

Start at the intersection of the base and center lines. Make *O A, O B, A C, B D, C R, A E, E K, B F, F L,* and *D S* each equal to the radius of the bolt. With *O* as the center and *O P* as radius, describe arc *H P G;* project the points *G* and *H*,



DRAWING HEXAGON NUTS.

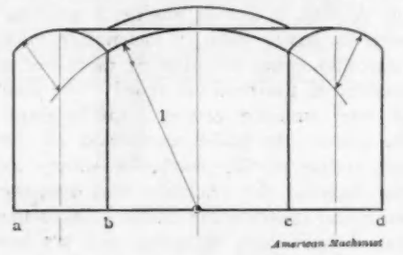
and *I* and *J;* draw light lines from *E* to *I* and from *R* to *G*. The points of intersection will be the centers of the small arcs. Use *O* as the center to draw the end of the bolt. GEO. HOLLOWAY.

Clyde, Ohio.

Editor American Machinist:

I notice in issue of your paper for April 20 articles on the drawing board construction of hexagonal nuts. I have been accustomed to use a method which appears to me simpler than any of those. The following is the construction:

The hight of the nut, of course, is equal to the diameter. The circles are drawn as shown; the radii of the small circles have



DRAWING HEXAGON NUTS.

centers midway between *a b* and *c d*, and on the circle drawn with radius *l*. This construction is simple and easily remembered. I am surprised that it is not more generally used. NAT J. SPARLING.

West Point Foundry.

[As this seems to be the simplest construction that has been elicited, and not likely to be much simplified, it seems to be a fitting conclusion of the series.—Ed.]

Gas Engine Experience.

Editor American Machinist:

Referring to the article in your issue of May 4 describing "A Simple Gas Engine," I venture to offer a word of criticism regarding an important detail. The method of allowing gas to go through holes on the side of a combination air and gas valve is very bad. The slightest possible particles of dirt, even less than will readily make the valve leak to an extent that will stop the engine running, will allow some pressure to blow up the little holes and blow the gas so far up the pipe that the next suction will fail to get the proper charge. It is almost impossible to keep such a valve in proper working condition. We know this from costly experience.

J. F. DENISON.

New Haven, Conn.

The Discussion of Small Things.

Editor American Machinist:

After reading a few of the numerous articles [at the date of our correspondent's letter the total number was five—Ed.] recently published in the "American Machinist," on drawing hexagon nuts, I wish to ask, as one of your correspondents did about the section liner, "What are these things for anyway?" They are usually given as studies for beginners in mechanical drawing, along with cubes and intersecting cylinders, and as such are no doubt useful; but a draftsman who keeps pace with our "end of the century" hustle has no time to fool away over such trifles. If he is making an exhibition drawing, with nuts on as large scale as the one in M. E.'s article, some method of laying out may be necessary to a man not gifted with a good eye; but on ordinary work, time spent in such a manner is not likely to be approved by the "boss."

The chances are that the plans for that bridge which upset our transatlantic cousins so recently had hexagon nuts without any curves at all; but I don't suppose anybody will mistake them for rivet heads or dowel pins on that account.

One of a good workman's good points is, knowing where and how to slight work when it does not detract from the real value of the product. Surely these hexagon-nut fellows would not advise machining an engine bed all over, or rate a machinist as a poor workman if he neglected to do so. This applies to the draftsman as well as to the machinist. If he used rules, recipes and diagrams for every nut, bolt and screw he had to indicate, his machine would be out of date before he got the drawings done.

Won't somebody please get up and talk awhile on "How to make the ink dry faster on shade lines"? It is more in keeping with modern ideas.

E. R. PLAISTED.

Montpelier, Vt.

The Water Works Pumping Plant That Failed.

The account which follows shows very distinctly how not to go about getting an efficient municipal water-pumping plant. It was contributed by Mr. E. R. Scales to a recent number of the "Transit."

"It was the writer's fortune to witness the experience of a small town which in-

stalled a gasoline-engine water supply plant. To one not having property in the town or interest in the plant a retrospective view is not without an amusing vein. The necessity of fire protection having been impressed upon the minds of the good people of the town referred to by a conflagration in a neighboring town, a meeting was held to perfect plans for a system of water-works. The town being too poor to undertake the work, a local stock company was formed. The holders of the stock were to receive 6 per cent. interest on the money invested, this interest to be paid by the town as rental for the plant, the city reserving the right to buy the plant after a term of years.

"The company organized and elected its officers; the man who furnished the most capital, as is usually the case, being the man who was most engineer. Not a man among them could tell a gasoline from a steam engine, or distinguish between a dynamo and motor, but each and every one advanced some new and startling theories on the matter of water supply. The contract for laying the mains, erecting a steel tower, and building the tank and pumping station was let to the lowest bidder. The tower was a substantial steel tower, 60 feet high and carried a wooden tank of 50,000 gallons capacity. The pump house was a square brick structure of no particular style of architecture, and the man who planned it forgot to specify a chimney, so the bidder, not wishing to alter his contract, put none on. The genial agent of a sham engine firm was early on the ground and stormed the directors with illustrated catalogs and arguments all pointing to the necessity of using a gasoline engine. His wonderful display of facts and figures could not help but convince the management that such a machine as he had to sell was the one for the place and they congratulated each other heartily as they thought how masterfully they had avoided the great expense of an engineer's salary.

"At last the engine arrived and the expert proceeded to install it. It was a wonderful machine, everything about it was cheap, except, possibly, the price. It looked as though the inventor had decided that the more rods and valves and moving parts he could use the better would be the engine, and he then proceeded to work all into it possible. It was belted to a line shaft, which, in turn, drove two deep-well pumps of uncertain pattern by means of a chain and sprocket; and a rotary fire pump by means of tight and loose pulleys. The exhaust was muffled by being led through a large wooden box filled with broken brick and elevated on timbers in one corner of the pump room. The box acted like a sounding board and greatly intensified the report. The violence of the exhaust and the explosions soon disintegrated the brick, and after the first run the electric light globes and everything in the vicinity wore a coating of red brick dust. It was immediately evident this experiment would not work, and the box and remaining pieces of brick were removed, the exhaust pipe being run outside and buried. This was the first of a long series of changes which finally resulted in the downfall of this automatic gasoline engine pumping plant.

"The first real test of the system came on a bright winter's morning; when the fire alarm was sounded the marshal hastened to the pumping plant to start the fire pump. He carefully read the printed directions tacked upon the wall, turned the screw marked *A*, poured some gasoline in the hole marked *B*, turned screw marked *C*, waited the required number of minutes and gave the wheel a turn. But the engine refused to start. For two hours the local engineer wrestled with that obstinate gasoline engine, but all efforts were futile. Meanwhile the citizens rallied to the rescue and extinguished the fire in the good old way before it had done extensive damage. But dissatisfaction was general, and the engine company finally replaced the engine with a new one, which differed from the former chiefly in having more valves, rods, moving parts and adjustments. Each day some piece of faulty construction revealed itself and some impromptu remedy was applied. The sprocket chains driving the pumps were continually being broken by the jerking motion of the pump. One director argued that fly-wheels on the line shafts would help matters, and accordingly two were purchased. Now arose a difference of opinion; one said the fly-wheels should be placed on the shaft that revolved the faster; another that they should be placed on the shaft that revolved the slower; so a compromise was made, and one wheel placed on each shaft. Then gearing was substituted for the chain and sprocket, and many other changes were made which might be enumerated. Meanwhile the plant passed under my hands; each week or two saw a new official try his hand and a disgusted one step down and out. The marshal was now elected upon his mechanical ability, and success in wrestling with the gasoline engine was the first and highest qualification for office. The town found itself obliged to pay large gasoline and repair bills and water was often noticeably scarce around the pumping plant. The expenses of operating far exceeded the income, and the venture proved itself a failure.

"Then the electric light company came to the rescue with a proposition to pump the water by electricity, the town to purchase a standard pump and the company to furnish motor and power and keep the plant in repair. The proposition being accepted, a motor and pump were installed in a good mechanical manner. The major part of the pumping is done when the lighting load is least, thus helping to bring the working load nearer to the point of maximum economy. The motor is started at the pump house by an employee of the light company, who also oils the machinery, i. e., fills the oilers and sees that they are set to feed properly. The plant is then locked and left to its own care, no further attention being required beyond an occasional overhauling by the company's engineer. The motor is thrown out of circuit by the engineer at the lighting station when an electric signal shows the tank to be full. This signal consists of a lamp on the switch board, which lights when the water in the tank reaches the required level. The gasoline engine still remains belted to the fire pump for emergency, but its glory has departed."

Importance of Europe to American Exporters—Slashing Prices.

I sometimes doubt if your manufacturers quite appreciate the value of the English and continental markets, while trying to win an entrance into some far-off, semi-civilized country. Anyway, I have examined the matter, and present herewith a short table giving the value of American manufactures shipped to England in 1895 and 1898:

EXPORTS TO UNITED KINGDOM.

	1898.	1895.
Agricultural implements	$1,236,436	$757,715
Carriages, cars, etc	735,787	364,361
Cycles	1,699,127	(1896) 1,306,408
Instruments for scientific purposes	742,219	.....
Builders' hardware	1,762,885	857,417
Sewing machines	892,654	848,069
Typewriting machines	934,243	.....

Europe has now become the best market for United States farm machinery, receiving over $5,000,000 worth a year out of a total of $9,000,000 worth exported to all countries. It is also very significant of American progress that while the total value of English implements and tools shipped abroad has only risen from $6,235,000 in 1895 to $6,545,000 in 1898, United States exports have increased from $5,319,885 to $9,073,000 during the same period.

Europe is also an increasingly good market for American cars and carriages; but the cycle trade has only about held its own throughout this part of the world. Rather more than one-third of the total apparatus exported from the United States comes to Europe; while about half of your exported hardware is sold on this side of the Atlantic, two-thirds of your sewing machines, and the same may almost be said for your typewriting machines. Taking only a few of the manufactured goods shipped by United States dealers, we see that Europe is one of the most important, if indeed she is not the leading center for American manufactures. Compared with continental countries the United Kingdom holds a first place in this respect, and the trade in all the articles mentioned above is capable of

large extension. For instance, as I write these lines news comes from Sheffield that very extensive orders have just been forwarded to America by one of our largest Sheffield firms, after efforts have been made to place the orders in England. Quotations were sought from all the large English houses, but, owing to pressure of work, none were able to promise delivery in less than from eight to ten months, while at least one declined to make any quotation. The United States firms have undertaken delivery in two to three months. The firm concerned owns one of the oldest engineering establishments in Sheffield, and has recently gone in for manufacturing dynamos and other plant required for the production of electricity. We are constantly being told that this refusal of orders is all due to the arrears of work caused by the engineers' strike of a year ago. That is all rubbish, or rather there is only a modicum of truth in it. The real cause of this congestion in British engineering shops is due largely (if not entirely) to the antiquated plant, obsolete patterns, and trade-union rules which govern the whole system of production. English engineering houses will never be able to hold their own until they adopt your system of manufacturing; while many of them should also burn most of their patterns, for they are no earthly use in competition with your goods, especially in machine tools. No pettifogging scheme of profit-sharing or reduction of hours of work or addition to the working day will have any real effect. The defects are in the system of production, and that will never be thoroughly altered until the English trades unions recognize English manufacturing needs.

Large as are the sales of American machinery in this country I think they would be still larger if it were finished off a little more and also made a trifle heavier. There is undoubtedly a strong feeling here in favor of heavier machinery than you supply. While a manager of one of our laundry engineering firms recently showed me a lot of your machines, which certainly left something to be desired as regards finish, I find also that some of the merchants here interested in the sale of American machinery and hardware complain that the representatives of United States houses on this side are too eager to get orders, and often accept a price that neither pays the firm nor does any good to the trade generally. This slashing of prices in the English and foreign markets has been attended to before in one of the consular reports, where it was aptly pointed out that if an order can be secured at, say, $10 a ton, there is no earthly purpose served in rushing after it and quoting $6 in one's eagerness to secure it. This is the part of the export business that American dealers have got to learn before they can reap half the full reward of a foreign trade. "This beggaring of business, these unnecessarily low prices, this absurd underbidding on the part of Americans is constantly brought to my attention here, and it is so foolish that sometimes it is fairly heartbreaking." That is what Mr. Halstead wrote from Birmingham last November. It is not a bit of good building up one of those open competitions where cost and profit of manufacture is forgotten in a fight to be the "successful" (?) seller.

The days of cheap and inferior machinery are numbered, so far at least as this market is concerned. The only reason why United States manufactures of this class are used here is that they are so far ahead of anything that can be had from home engineers. Therefore keep up to the present high standard. Therein lies the secret of your success, both in England and on the Continent. If any attempts are made by really responsible firms to lower the quality of their machinery and tools shipped to the United Kingdom it will spoil the trade more than anything else. That is one reason why so much prejudice exists in England against United States bicycles. Shiploads of second and third-rate cycles were sent here eighteen months ago and simply damned the American trade. A Scotch dealer in your machinery says that he has never yet had reason to complain of a failure on the part of an American manufacturer to properly fill a definite order; the only thing which does occur now and again is an attempt to send something "like" the article ordered, "to see if it will serve." That should be avoided.

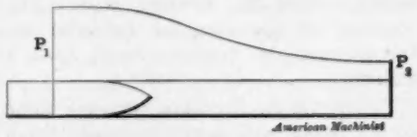
F. C. CHAPPELL.

London, England.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(57) R. V. asks: Is the impelling force of nitro, or smokeless powder, exerted most at the start, or do the gases follow up the charge more closely than is the case with black powder? A.—Lieut. J. F. Meigs, engineer of ordnance, with the Bethlehem Iron Company, answers this inquiry as follows: In all large guns there is no doubt that the pressure against the shot's base holds up better towards the gun's muzzle with modern or smokeless



powders than with the older smoke-giving powders. In other words, with modern powders, the muzzle pressures are greater, as compared with the breech pressures, than with older powders. The proof of this lies in the fact that with fixed weights of projectiles and equal (or lower) breech pressures, greater muzzle velocities are reached by the projectiles. The only pressure directly measured in guns usually is that on the front of the breech plug or bottom of the bore. The other pressures are judged of and measured by measuring the projectile's velocity. An indicator diagram may be drawn with more or less accuracy over the gun in much the same way as with steam cylinders. As, with fixed weights of projectiles and fixed breech pressures, the area under these curves is greater with modern smokeless than with older powders, it follows of necessity that the pressures of the former as the shot passes the chase and muzzle of the gun must be greater than with the latter.

(58) S., Baltimore, Md., asks for formulas for the strength of conical and flat pistons. A.—We know of no satisfactory analytical formulas for this purpose, and doubt if such formulas are possible. The following empirical formulas are from "Seaton's Manual of Marine Engineering," and from their source are doubtless entitled to confidence. Let D be the diameter of the piston in inches, p the effective pressure per square inch on it, x a constant multiplier, found as follows:

$$x = \frac{D}{50} \times \sqrt{p} + 1$$

Cast Iron Pistons [hollow box type].
Thickness of front near boss = $.2\,x$.
Thickness of front near rim = $.17\,x$.
Thickness of back = $.18\,x$.
Thickness of boss around rod = $.3\,x$.
Thickness of flange inside packing ring = $.23\,x$.
Thickness of junk ring at edge = $.23\,x$.
Thickness of junk ring at bolt holes = $.35\,x$.
Depth of piston at center = $1.4\,x$.
Diameter of junk ring bolts = $.1\,x$.
Pitch of junk ring bolts = 10 diameters.
Number of webs in piston $\frac{D + 20}{12}$
Thickness of webs in piston = $.18\,x$.

Cast Steel Pistons [conical type.]
Thickness near boss = $.26\,x$.
Thickness near rim = $.15\,x$.

No rule is given for the angle of the cone of conical pistons, but an engraving of such a piston shows the angle at the apex to be 120 degrees.

The Black Country of England.

BY W. H. BOOTH.

It may sometimes happen that the very abundance of nature's resources is productive of loss and injury. An overplus of facilities is apt, in the early stages of any industry, to inculcate wasteful and extravagant courses which may ultimately place a district very far behind in the race. Something of this sort has taken place in that part of England known as the South Staffordshire or Dudley coal field, this being the district commonly known as the "Black Country." Some idea of the richness of the country may be had when I say that the Dudley thick coal runs as much as 12 yards in thick-

ness, and it is not the only seam of coal in the district. The enormous thickness of 12 yards is due to the fact that several seams of coal unite to form one thick seam, and at a distance from the center of the main body the seam divides into several seams at more or less considerable distances apart. The abundance of the coal and its nearness to the surface have enabled men of small means to work it, and the result is that the coal field is dotted all over with abandoned pits. The field has been worked in little areas, and so it has come about that, while much has been removed, there are left untouched masses of coal in between, which, while aggregating a considerable amount, will not pay to take out. Then, again, the working has been so neglectfully done that shafts have been badly "tubbed," and the water has not been shut back and finds its way into the lower workings, so that large areas of coal are now waterlogged and cannot be won except at a heavy cost in pumping, and it is very difficult to get this done in a broad and liberal manner.

But, apart from the above reasons, there are others which explain the comparative poverty of the district. I do not mean poverty actually, for all the iron works are hard at work night and day, and cannot fill the orders they have in hand. But owing to the fact that the peculiar rights, or mights, of the landowner allow him to mine coal beneath anybody's property, there is no security for buildings, no compensation being given for damage done by subsidence. The removal of 12 yards of a coal seam has naturally a very serious effect upon buildings, and it is practically a truth that there is not a plumb building over many square miles, and in some cases whole townships are completely wrecked, and scores of houses brought to the ground. Naturally, no man will build anything fit to look at until he is assured that the land has been finally mined out and has come to rest, and the district is rendered ugly in every sense. The very ease of getting coal and iron has, as said before, made men careless and wasteful, and demanded less skill and intelligence than otherwise would be the case, and for this, among other reasons, we find manufacturers behindhand.

This district ought in every sense to lead the world in iron and steel making. It does not do so now, though it once did, simply because of the above causes. Its growth has been too easy. When men lay down their street sewers in solid coal, as has been at times done in or near Dudley, they are apt to be easy in other matters. In Yorkshire or Nottinghamshire a pit may be 400 or 500 yards deep, and it is necessary there to have excellent machinery at the pit head. I have known many of the Yorkshire collieries, and have found high-class winding engines and pithead work generally. Now here in Staffordshire one sees beam engines probably a century old, or nearly so, and the whole pit-head gear has a temporary, paltry appearance. The disposal of the spoil also is slovenly, and generally there is in everything a tendency to slovenly work in coal-getting, and all because of nature being too beneficent.

It was from this district that years ago, when steam boilers were of iron, the excellent Staffordshire boiler plate came. The "Black Country" is a district closely dotted with towns, in each of which there is some special class of manufacture carried on. Thus tubes are made at Wednesbury, hardware at Wolverhampton, and there are localities for chains, for anchors, rolls, and so on, and they are all so busy that foreign goods are coming largely into the district without a murmur. This is all right up to a point, but if the manufacturers here had been less wasteful they might have had larger works and better appointed, and they could have done work at less prices, and no foreign goods could possibly have competed. A curious feature here is that when a works has been abandoned it is left all standing, with an enormous amount of old machinery to rust gradually away. Close by where fortune has thrown my lot for a few weeks, I have found such an old works. It never can be worked again, but the boiler and engine remain as evidences of antiquity. The old engine is of beam type, and, so far as I could see in a dim light, steam was admitted only to the top of the cylinder, then exhausted round to the bottom end of the cylinder, and thence to the con denser.

On the rod which works the air pump are bolted blocks of wood which strike upon curiously curved handles, such as may be seen in historical works on the steam engine. These handles work the valves, and were used in starting the engine from rest. The engine is thus a Cornish engine. The cylinder is about 5 feet across, and much of the framing is of wood. The steam pipes are square.

It is a curious fact that in a great part of this busy district (for despite all that strikes me as faulty, there can be no dispute as to the enormous industry of the Black Country) there is very little passenger railway accommodation. There are many freight lines from coal mines to different works and so on, but practically no railway to carry passengers. Trains are very few and slow, and the steam tramways, of which there is some considerable mileage, have never been seriously worked.

Now, however, the district has been invaded by electrical tramways, and these will do an enormous business as well as affording an outlet to the country round about, or rather to the West, for the Black Country ends suddenly, and you can step in five minutes from cinder heaps to a green country of remarkable natural beauty. In place of living in broken down hovels, tied up where possible by a multiplicity of iron staybolts, the electrical tramway will in a few minutes enable people to spread themselves out wider. This can only be done by means of the frequent service afforded by electrically-worked tramways, which cannot fail to practically obliterate the passenger traffic on the steam railroads. Rapid and frequent service is what an industrial district like this requires. Electrical tramways have been much delayed in England by the objection to the overhead or trolley system. Curiously enough the most serious objection comes from the worst built towns. Along main roads here, where nothing but absolute ugliness prevails and where highly-paid men are obliged to live in squalid houses, simply for lack of any others, objections are raised to neat clean cars and all the advantages they will confer, simply because of some fancied objection to an overhead system. There may be some ground for this objection. The erection of the poles at frequent intervals along the road side shows something. Every truly vertical pole is a sort of datum line of perpendicularity. It points out to every eye that there are no vertical buildings. Everything is awry by reason of the settlement of the ground, the subsidence due to the removal of the coal beneath. The upright pole is a silent witness to the ugliness of the land, and possibly acts as a teacher and points to improvement. But for the present the electrical tramway in England has not been well treated. The people want them and they are eminently necessary to connect adjacent towns and open up suburbs. Unfortunately many municipal authorities have gone outside their proper field and have been jealous of tramway companies and have actually prevented their construction, though not themselves able to construct lines, except within the narrow limits of their own boroughs. Tramways, are so evidently common to all that no locality can have its own and shut off the adjacent country without suffering loss. I have no doubt myself that all the towns which succeed in depriving themselves of the electric lines will be doomed to decay as surely as were the towns of seventy years ago which refused to allow steam railroads to come near them. I have occasion at times to go to some of those once prosperous towns. To-day they are asleep, grass grows in their streets, and other towns have sprung up near the railroads. It looks like history repeating itself.

Technical Publications.

"Mechanical Movements, Powers, Devices and Appliances." By G. D. Hiscox. 402 6x9-inch pages, with 1,649 illustrations. Norman W. Henley & Co. Price $3.

This book may be called an illustrated mechanical dictionary, the various movements and combinations being described in the briefest language. Nearly every

field in which machinery is used is covered, the characteristic constructions of each field being shown.

"Experience With the Premium Plan of Paying for Labor." By F. A. Halsey. American Machinist Press, New York.

This is a pamphlet reprint of Mr. Halsey's article on the subject which appeared in our issue of March 9 last and which has attracted so much attention as to make this subsequent publication necessary to supply the demand for it. Its circulation and general study can hardly fail to have a good effect, and a copy of the pamphlet will be sent free to any address on application.

"Notes on Descriptive Geometry." By W. L. Ames. 89 4½x6-inch pages, with 95 illustrations. Mrs. S. P. Burton, Terre Haute, Ind. Price 50 cents.

Most books on descriptive geometry use the first angle of projection, while the third angle finds increasing favor for construction drawings, and is obviously destined to become universal. The condition of things described leads to great mental confusion on the student's part when called upon to apply the problems and constructions of descriptive geometry to constructive work, and it is primarily to avoid this confusion that this little book has been prepared. The spirit which led to the preparation of the book is manifested throughout, many of the numerous problems being of a strictly practical nature, such in fact as arise in everyday work. We have seen no book on the subject which has pleased us more. Those beginning the study of drawing will find nothing more useful or helpful in forming sound conceptions of projections, intersections, etc. In this respect its value is not to be measured by its price.

"Practical Engineering Drawing and Third Angle Projection." By F. N. Willson. 189 10x12-inch pages, with over 400 illustrations. The Macmillan Company. Price $2.80.

From all points of view this is an admirable piece of book-making. The author writes as one who is in love with his subject, and the genuine student will find a corresponding degree of interest in his pages. The book is much more than a drawing book, in the ordinary understanding of that term. Many of the historical mathematical curves, with their leading properties are described. The confused notation of rolled curves is corrected and the curious inter-relationships of such curves are pointed out. Projections and intersections are taught by the third-angle method, and the student does not have to struggle with principles taught by one method and applications taught by another. The mechanical make-up of the book, in paper, engravings and press work, is of the first order of excellence—we have, in fact, seen nothing finer.

A very excellent paper describing the results of experiments to determine the efficiency of the bicycle under various conditions is published in the last number of the "Journal of the Association of Engineering Societies." This paper is by Prof. Robert H. Fernald, of the Case School, Cleveland, and describes the methods by which the conditions of actual service were approximated as closely as possible, and gives diagrams and figures of results. Chain wheels of various qualities were tried, and also chainless wheels, and one general result that may be drawn from the experiments is to the effect that there is a far greater difference in efficiency between a first-class chain wheel and an inferior chain wheel than between a chain wheel and a chainless wheel of about the same grade. It is also shown that new wheels may not be as efficient as the same wheels when they have been used for a time.

There will be conducted at Lehigh University, South Bethlehem, Pa., from July 5 to August 16, 1899, a summer school, and among the courses of study to be followed, those which appeal most to mechanics generally are electrical engineering and physics, chemistry and mathematics. All applicants who are duly qualified to take these courses may do so, and applications for admission to the summer school should reach the secretary of the University not later than June 15.

Personal.

Joseph A. Fux, consulting mechanical engineer, of Brantford, Ontario, is spending a few months in Europe.

William Mattern, late superintendent of the Columbia Iron Company's Works, has been appointed general manager of the Fullerton Iron Company's plant at Fullerton, Pa.

Our occasional contributor, D. E. McCarthy, has taken a position as special draftsman in the department of tools and fixtures of the Westinghouse Electric & Manufacturing Company, East Pittsburgh.

Obituary.

Henry D. Stone died recently at Windsor, Vt.; eighty-four years old. He was born in Plainfield, N. H., and moved to Windsor in 1847. He was draftsman and later superintendent of the Jones & Lamson Machine Company, and was one of the first designers and improvers of the turret screw machine.

Isaac Gale Johnson, the well-known malleable iron manufacturer, died at his home, Spuyten Duyvil, N. Y., June 3; sixty-eight years old. Mr. Johnson was born in Troy, N. Y., his father, Elias Johnson having been one of the pioneer stove manufacturers of that city. He graduated from Rensselaer Polytechnic Institute in 1848, and then spent two winters in special studies in Philadelphia, after which he established the plant at Spuyten Duyvil, where he acquired great wealth. During the Civil War he secured a contract for cannon, but was dependent upon a single source for a supply of iron which would satisfy the requirements. The maneuverings of business after a time prevented him from obtaining the necessary iron, when, as the result of persistent experimenting, he produced a mixture, composed chiefly of the cheapest ores, which proved superior to any previously employed. Mr. Johnson did much to develop and improve malleable iron and steel casting. In later years he had been interested in projectiles, and among other things devised a lubricating cap for armor-piercing shells, which was purchased by the Navy Department and was effectively used in the destruction of Cervera's fleet. Mr. Johnson is survived by a widow and five sons, all of whom have been associated with him in business.

The power plant of the Waldorf-Astoria hotel in New York has a boiler capacity equal to 4,000 horse-power; electric generators capable of developing 1,500 kilowatts; 25,000 electric lights; a refrigerating plant with a cooling capacity equal to melting 150 tons of ice per day, and pumps sufficient to supply water to a city of 400,000 inhabitants. There are 152 steam and 102 water cylinders, and 56 electric motors. One hundred and sixteen men are employed in the engineer force.

Owing to the fact that the manufacturers of armor plate refused recently to undertake contracts for armor plate at the price fixed by Congress, no step can be

(*Continued on page 41.*)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 16.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Boiler-maker's punch and shears wanted. at Dover Boiler Works, Dover, N. J.

The Dutton Wet Twist Drill Grinder is sold by the Garvin Machine Co., New York City.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," price $1, post paid. J.L.Lucas,Prov.,R.I. Send for index sheet.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Wanted—One copy of "American Machinist for May 27, 1897, or bound volume for entire year. P. O. Box 149, Lorin, Cal.

Bound volumes of "American Machinist" for 1893 and 1894, cloth, good condition, $3 each; one of 1888, morocco, $4. "Volumes," care AMERICAN MACHINIST.

The Waltham Machine Works, Waltham, Mass., make a specialty of accurate work. Correspondence in regard to small automatic machinery, punches and dies, etc., is solicited.

Institutions retiring from business having machine tools, brass or wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisement under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Position as layer-out in boiler works, by practical boiler maker. Box 38, AM. MACH.

Draftsman wants change; four years' experience on cotton machinery; references furnished. Box 18, AMERICAN MACHINIST.

Foreman of iron foundry will change; wanted, shop on special work, machinery; first-class reference; experienced. Address Box 36, AMERICAN MACHINIST.

Situation, by a thorough mechanic with shop drawing-room and traveling experience in machine tools; can add new line of profitable machines with right parties. Address Box 12, AMERICAN MACHINIST.

Help Wanted.

Wanted—A first-class draftsman for detail work and shop tools. Apply to Box 32, AMERICAN MACHINIST.

Wanted—Mechanical draftsman on pumps; state experience, salary, age and give references. Box 35, AMERICAN MACHINIST.

Wanted—Draftsman to design high-pressure compressors, for carbonic acid gas and liquid air. Box 34, AMERICAN MACHINIST.

Wanted—A No. 1 draftsman and designer; one who has had experience on electric traveling crane work. Address Box 16, A. MACH.

Wanted—Draftsman familiar with large vertical engine design. Address, stating references and salary, P. O. Box 452, Pittsburgh, Pa.

Several first-class tool makers wanted on light interchangeable work; state age, experience and wages expected. Box 28, AMERICAN MACHINIST.

Wanted—First-class machinists for floor and vise work; best class heavy machine work; good wages; steady employment. Morgan Engineering Co., Alliance, Ohio.

Wanted—Stock clerk to take charge of finished-stock department in factory; address in own handwriting, sending letters of reference; State salary expected. Address Box 33, AMERICAN MACHINIST.

Wanted—Two good machinists, two molders and one more pattern maker can find steady employment and good wages by applying or addressing, stating age, experience, to Kenney & Co., Scottdale, Pa.

Wanted—Pattern makers and machinists on high-grade compound steam-engine work; applicants will please give full particulars, such as age, salary, experience, last or present place employed. Address Box 31, AMER. MACH.

Wanted—By well-known company, manufacturing generators and motors, a foreman for the machine shop; one who has had experience in similar work preferred; state experience and salary expected. Address Box 37, AMERICAN MACHINIST.

Wanted—Foreman, by an old, reliable firm in the steam fittings and brass goods line in the center of Germany, for brass foundry employing about 70 men; knowledge of German language required; state experience, age and wages expected. Box 335, AMER. MACHINIST.

Draftsman Wanted—A steady position is open to a draftsman capable of designing machinery under advice; must have some acquaintance with modern shop methods; applicants will please give full particulars, such as age, salary required, experience, etc. Box 10, AMERICAN MACHINIST.

PATENTS secured in the United States and foreign countries. Investigations as to novelty and validity. Litigation conducted in the Courts and Patent Office. Members of the bar of the United States Supreme Court and various Circuit Courts.

BALDWIN, DAVIDSON & WIGHT,
25 Grant Pl., Washington, D. C. 141 Broadway, New York.

THE PRICE OF A CIGAR

a day and some of your spare time devoted to study at home will secure you a thorough technical education. The education will qualify you for a better position and higher pay. Courses by mail in

Mechanical, Steam and Electrical Engineering,
Mechanical Drawing and Machine Design.
Best Text Books and Drawing Plates Free.

Seven years of experience in teaching by correspondence. Write for our illustrated Circular T, sample pages of text books, drawing plate and booklet of letters from students all over the world.

The United Correspondence Schools,
154, 156, 158 Fifth Ave., New York.

The CROSS OIL FILTER

actually reduces oil bills 50% or more. Sent on approval. Capacities 3 to 150 gals. per day. Used in 23 countries. Testimonials from the leading firms in every field of industry.

THE BURT MFG. CO.
AKRON, OHIO, U.S.A.
Business Established 9 Years.
Largest Manufacturers of Oil Filters in the World.

CLEVELAND GEAR WORKS,
W. R. SAWYER, Lessee.
86 SENECA STREET,
CLEVELAND.

GEARS of all descriptions

We Plane Steel Gears

faster and better than you mill cast iron ones. You wouldn't ask the reason after seeing the chips. They roll up like chips from a lathe tool. We don't scrape them off, but cut them off. Cutter has a top rake you know. Let us tell you more about it.

The Fellows Gear Shaper Co.,
SPRINGFIELD, VT.

KEUFFEL & ESSER CO.
NEW YORK.
127 FULTON STREET
Branches: 111 Madison St., Chicago.
708 Locust St., St. Louis.
Drawing Materials and Surveying Instruments.

We make and carry the most complete and best assorted stock in America. Our goods are recognized as the standard of quality. They all bear our trade mark and are warranted by us. Our prices are reasonable. Our lavishly illustrated catalog minutely and correctly describes our goods. It contains much valuable information, and is sent gratis on application.

NEW SURFACE GAUGE

No. 100

PERFECT ADJUSTMENT.
UNEQUALLED SCOPE.
Price with 6 and 10 inch spindle, $2.50.
MADE BY THE
SAWYER TOOL CO.,
FITCHBURG, MASS.

(*Continued from page 40.*)

taken for some time in the construction of the three battleships and three armored cruisers authorized by the last Congress, as the act authorizing the construction of those vessels contains a clause which forbids the Navy Department from contracting for the construction of their hulls until a contract has been made for the armor at a price not to exceed $300 per ton.

Mr. Janssens on the Paris Exposition.

Adolphe Janssens, of Paris, arrived on the 3d inst., and will remain here about six weeks looking into machine-tool matters. Mr. Janssens is especially interested in the exhibit of American machine tools at Paris next year, and thinks the plan of a separate building at Vincennes, in which tools can be shown in adequate space and at work, will be approved and will turn out to be an excellent one. He most earnestly hopes that American tool builders will make a display worthy of themselves, and that they will not be outdone by exhibitors from other countries, who will not fail to make use of such an opportunity if it is presented to them by the indifference or dissatisfaction of our builders.

Andrew Carnegie has given $50,000 to the Stevens Institute of Technology for the erection of an engineering laboratory. In his letter to President Henry Morton Mr. Carnegie says:

"My Dear President—It would give me the very greatest pleasure to devote $50,000 to the building of the engineering laboratory, as you suggest. We owe much to Stevens, for very many valuable men have come to us from it."

In a five-mile motor cycle race recently held at the Crystal Palace, London, the bicycle record was beaten. Four vehicles started, but two dropped out. The other two kept very close together for the entire run. The running time was 8:22⅗; the bicycle record for the same distance being 8:47⅕. The machines had three wheels and were driven by petroleum.

Manufacturers.

The Eastern District Company is erecting a new plant at Peekskill, N. Y.

Berry & Hotz, Edwardsville, N. Y., contemplate the enlargement of their factory.

H. S. Albright & Co., Pottsville, Pa., have torn down the building adjoining their factory and will soon commence to enlarge their present plant.

The Barnes Machine Company, Oshkosh, Wis., which was burned out recently, has decided to immediately rebuild its plant, at an expenditure of $60,000.

The plant of Studebaker Bros. Manufacturing Company, South Bend, Ind., will be considerably enlarged in order to supply the increased demand for automobiles.

It is said that Paul Jones & Co. are soor

to commence the erection of a large distillery at Louisville, Ky. It is expected the new plant will cost more than $250,000.

The High Shoals Manufacturing Company has bought 1,200 acres of land on the Catawba River, near Lincolnton, N. C., and will build a $150,000 cotton mill and electric power plant.

Increase in business has necessitated the J. J. Vollrath Manufacturing Company, Sheboygan, Wis., to build an addition to its plant, work upon which has been commenced; it is to be 68 by 50 feet.

The H. K. Porter Company, of Pittsburgh, announces that the firm of H. K. Porter & Co. has been succeeded by the H. K. Porter Company. The company is erecting a new erecting shop 160x86 feet.

It is reported that a new pipe mill will be erected at Lancaster, Pa. Mr. J. B. Hillman, superintendent of the pipe mill at Middletown, Pa., is largely interested in the proposed plant to be erected at Lancaster.

W. R. Colcord Machinery Company has removed its office and store rooms to 423 and 425 North Second street, St. Louis, Mo.—more commodious quarters enabling them to carry a larger and more varied stock of machine tools, lathes, shapers, drills, milling machines, grinding machines, etc.

The Taft-Pierce Company, of Woonsocket, R. I., is to erect a three-story addition to the plant. The addition will eventually contain about $75,000 worth of machinery, and the force of employees will be considerably increased. Machine tools of practically all kinds will be required. The structure will be 315 feet long and 44 feet wide.

Fred. J. Swain has removed his shop from 207 Chestnut to 930 and 932 North Main street, St. Louis. This new shop gives him a floor space of over 12,000 feet, spread over three stories, and divided into blacksmith's shop, machine shop, drafting room, pattern room and tool room. The entire machinery is driven by a General Electric motor, with the exception of the large fan in the blacksmith's shop, driven by a Crocker-Wheeler motor. Mr. Swain reports the demand for presses, dies and sheet metal working tools to be excellent, and expects, with his new facilities, to be able to keep a little more abreast of his orders.

New Catalogs.

The Western Manufacturing Company, of Springfield, Ohio, has issued a catalog in which are illustrated and described lathe, planer and shaper tools. The catalog is standard size, 6x9 inches.

The Chisholm & Moore Manufacturing Company, of Cleveland, Ohio, sends us catalog containing illustrations and descriptions of chain hoists operated by electricity, compressed air and hand power. The catalog is standard size, 6x9 inches.

From the Weber Gas & Gasoline Engine Company, Kansas City, Mo., we have received small catalog which contains a number of facsimile commendatory letters from mining engineers who have used and are using Weber hoisting engines. The catalog is small standard size, 3½x6 inches.

L. S. Heald & Son, Barre, Mass., have sent us copy of catalog which illustrates and describes the American twist-drill grinder manufactured by them. These grinders are made in three styles and to grind drills from ⅛ to 2 inches. The various points of novelty claimed for this grinder are gone into fully. The catalog is standard size, 6x9 inches.

Fairbanks, Morse & Co., Cleveland, Ohio,

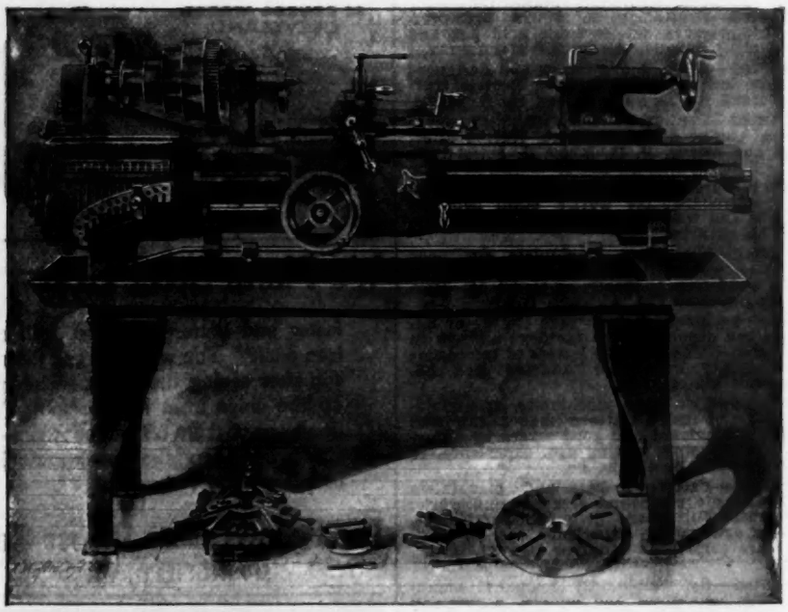
(*Continued on page* 43.)

The Hendey Machine Co.

TORRINGTON, CONN.

This Company is the sole owner of Letters Patents Nos. 468,183, 470,591, 519,294, 549,006 and 557,031, granted to P. & W. Schellenbach, W. P. Norton, and W. L. Schellenbach, for Improvements in Engine Lathes.

We take this method of notifying the public that we have already commenced suit against infringers of these patents, and that should it be found necessary to the protection of our rights, additional suits will be brought against manufacturers, vendors and users of infringing lathes.



The merits of these improvements have been widely recognized and have been wantonly copied. We shall take vigorous steps to protect our own.

The Hendey Machine Co.,

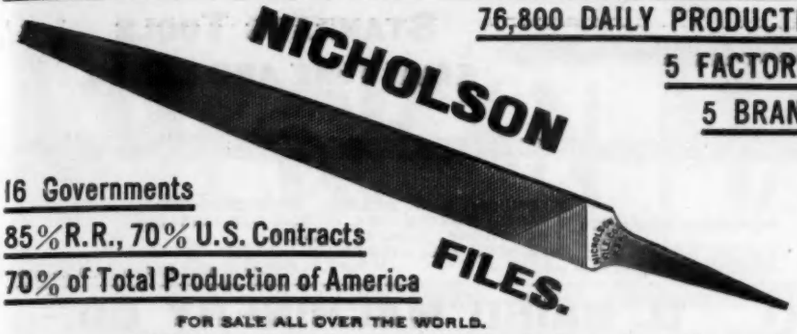
TORRINGTON, CONN.

UNITED STATES AGENTS:

Hill, Clarke & Co., Boston. Manning, Maxwell & Moore and The Garvin Machine Co., New York. J. W. Cregar, Philadelphia. U. Baird Machinery Co., Pittsburgh. The E. A. Kinsey Co., Cincinnati. Manning, Maxwell & Moore, Chicago. Pacific Tool & Supply Co., San Francisco.

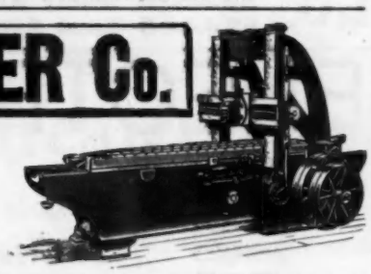
EUROPEAN AGENTS:

Schuchardt & Schütte, Berlin, Vienna, Brussels, Stockholm. Chas. Churchill & Co., London and Birmingham, England. Adolphe Janssens, Paris, France.
Stussi & Zweifel, Milan, Italy.



76,800 DAILY PRODUCTION
5 FACTORIES
5 BRANDS
16 Governments
85% R.R., 70% U.S. Contracts
70% of Total Production of America
FOR SALE ALL OVER THE WORLD.
NICHOLSON FILE CO., Providence, R. I., U. S. A.

POWELL PLANER Co.
WORCESTER, MASS.
U. Baird Machinery Co., 125 Water St., Pittsburgh, Pa.
Robinson & Cary Co., St. Paul, Minn.
W. R. Colcord Mchy Co., 502 North 3d St., St. Louis, Mo.
Parke & Lacy Co., Fremont St., San Francisco, Cal.
The Fairbanks Co., 705 Arch St., Philadelphia, Pa.



Excelsior Straight-Way Back Pressure Valve.

This valve has no dash pots, springs, guides or complicated levers to get out of order. It is simple, reliable and well made. Never sticks, and can be relied upon at all times when using exhaust steam for heating; or when used as a relief, or free exhaust on a condensing plant, it has no equal. It is noiseless and free from any complicated attachments.

Jenkins Brothers, New York, Boston, Philadelphia, Chicago.

TWENTY-FIRST EDITION, REWRITTEN. Locomotive Engine Running and Management.

Showing how to manage locomotive in running different kinds of trains with economy and dispatch; giving plain descriptions of valve-gear, injectors, brakes, lubricators, and other locomotive attachments; treating on the economical use of fuel and steam; and presenting valuable directions about the care, management, and repairs of locomotives and their connections.

By ANGUS SINCLAIR, *Member of the Brotherhood of Locomotive Engineers; of the American Railway Master Mechanics' Association; of the American Society of Mechanical Engineers, etc.*

xxxvi+438 pages; 55 figures. 12mo. Cloth. $2.00. JOHN WILEY & SONS, 53 E. 10th St., New York City.

NO GRINDING DELAYS.

Your work is undoubtedly often delayed if you are using emery wheels for your grinding.

CARBORUNDUM

wheels, when properly selected, never require dressing, because, on account of their extreme hardness and brittleness, they wear away evenly, and at the same time keep the cutting surface fresh and sharp.

Carborundum is guaranteed to be superior to emery on all abrasive work, and to produce profitable results to the purchaser.

THE CARBORUNDUM CO., NIAGARA FALLS, N.Y.

TOOLS A Large Asssortment of Regular and Special Tools for Machinists.

If you want "The Best That's Made," write us.

HAMMACHER, SCHLEMMER & CO., 209 BOWERY, NEW YORK.

Card makes all sorts of good Screw Plates. This particular one is especially adapted to the uses of machinists, gunsmiths and electricians. If there's a single thing you need in this line, or in Taps or Dies, better write for the "Brown Book."

S. W. Card Manufacturing Co., Mansfield, Mass., U. S. A.

(*Continued from page 42.*)

send us catalog of gasoline marine engines. Details regarding gasoline consumption, ignition mechanism, lubrication, etc., are given, and the catalog also contains a number of pictures of launches equipped with these motors. The catalog is standard size, 6x9 inches.

We have just received from the Westinghouse Electric & Manufacturing Company, Pittsburgh, catalogs Nos. 222, 223, 225, 226 and 228, describing and illustrating railway generators, lightning arresters, alternating and direct-current fan motors and induction motors. The catalogs are neatly printed, and very full details of the different machines are given.

The Baush & Harris Machine Tool Company, Springfield, Mass., has issued new catalog of machine tools, including radial drills, boring and turning mills, etc. The various machines are described in detail, and the whole make-up of the catalog is calculated to give those interested a very clear idea of the uses to which the machines illustrated may be put. The catalog is standard size, 6x9 inches.

The Gardner Motor Company, of New Orleans, La., has issued a new catalog illustrating and describing the various sizes and styles of the "Gardner" motor, which is driven by gasoline. These motors are especially adapted to the propulsion of launches, and numerous illustrations of launches equipped with these motors, and accompanied by a statement regarding their performances, are given. The catalog is standard size, 6x9 inches.

Wm. Gaertner & Co., Chicago, Ill., have sent us circulars "M" and "S," the first named of which illustrates and describes microscopes with and without micrometers, microscope supports, spherometers and other instruments of precision. Circular "S" is devoted to the illustration and description of supports such as are found in laboratories, table clamps, microscope supports, telescope and scale supports, etc. Both circulars are standard size, 6x9 inches.

We have received a copy of Catalog "D" of the Standard Pneumatic Tool Company, Chicago. This contains illustrations and descriptions of pneumatic drills of various sizes and styles, pneumatic hammers especially adapted for chipping, calking, etc.; riveting machines capable of driving rivets up to 1¼ inches in diameter, pneumatic chain hoists and numerous other devices operated by compressed air. The catalog is 6x9½ inches.

The Ferracute Machine Company, of Bridgeton, N. J., U. S. A., has recently published a complete catalog giving valuable information in regard to tools for sheet-metal work. This company manufactures over 300 sizes and kinds of presses, spinning lathes, beaders, etc., and has special facilities for turning out dies of all kinds. They will be glad to send a copy of their catalog to those who are interested, upon application, mentioning the "American Machinist."

The Brown Hoisting & Conveying Machine Company, Cleveland, has issued a new 1899 catalog devoted to the illustration and description of cranes of various types and capacities, including locomotive cranes, electric traveling cranes, cantilever and gantry cranes, jib cranes, etc. Following the various sections devoted to certain classes of cranes is given a list of recent purchasers of the type of crane referred to. All cranes illustrated are accompanied by an account of construction and method of operation. Altogether the catalog is a fine example of press work, and to those interested in the installation of hoisting machinery it should prove of great interest. It is bound in cloth and contains 172 6x9-inch pages.

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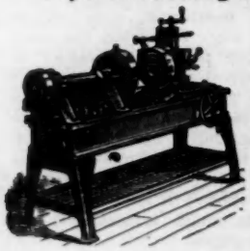

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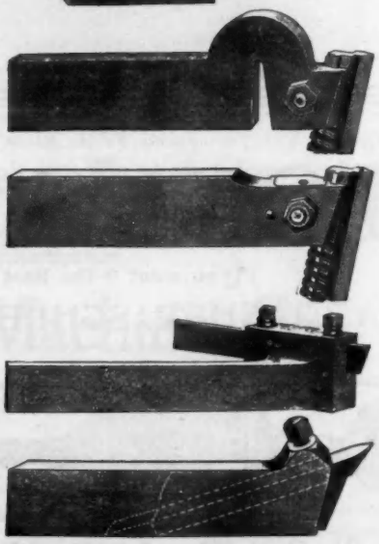

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